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JOURNAL OF FARM ECONOMICS

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No. 4

THE USE OF "PARS" AND "NORMAL" IN FORECAST- ING CROP PRODUCTION

BY W. F. CALLANDER AND JOSEPH A. BECKER

BUREAU OF AGRICULTURAL ECONOMICS, U. S. DEPARTMENT OF AGRICULTURE

Quantitative forecasting of the out-turn of crops months in advance of harvest, at least by official or government agencies, is of comparatively recent origin. It is confined as yet to a few countries. Forecasting was begun in the United States in 1912. The technique or science of forecasting has not yet reached the highest degree of perfection, the methods used being largely empirical. Much has depended upon the personal judgment and intuition of the statisticians, but little having been done in the development of mathematical formulae. The field is broad and inviting to statisticians. Only a beginning in the development of a scientific technique has been made.

The value to agricultural commerce of accurate forecasts of production cannot be questioned, and information as to crop prospects is especially of value not only to those producing or dealing in farm products, but to almost every line of commercial endeavor. For instance, railroads are vitally interested in forecasts because of the problem of furnishing cars to move the crops. Furthermore, crop production is regarded as one of the important barometrical indicators of future industrial conditions.

The two important factors necessary to a quantitative expression of crop production are (1) acreage, and (2) yield per acre. The determination of acreage from year to year is an entirely distinct and separate problem from that of forecasting the yield and has no relation to, or connection with, the

determination of the probable yield per acre. The acreage factor will not be discussed in this article.

Probable Yield Interpreted from Present Condition.

The methods so far used by the United States Department of Agriculture in forecasting yield are based upon the relation of condition reports, or estimates of the condition of the crop expressed as a percentage of normal in the current year, interpreted on the basis of the relation of condition and final yield in past years.

The term "forecasting" as used by the Department refers to the interpretation of current condition into probable yield on the basis of past relations for the particular date. The interpretation is on the assumption of average change in condition of the crop until harvest. Since conditions subsequent to a given date are seldom average, the final yield may be more or less than the forecasted yield, depending on whether or not conditions are more or less favorable than the average. No attempt is made to forecast the future departure of condition from the average. Such forecasts would necessitate long time weather forecasts, which so far have not been made in terms applicable to use in this work.

Forecasting Methods Not Uniform.

No other country, as far as the writers are aware, uses as a measure of condition the term "normal" in the sense in which it is used in the United States. The Canadian Government formerly used the "normal" or "standard," but changed to another basis in 1918. In England, crop conditions are expressed as a percentage of the average yield per acre for the preceding ten years, which they call "normal," but the word is used in the sense of "average." This is the method now used by the Canadian and Norwegian Governments. In Hungary, forecasts are made prior to harvest based upon direct questions to reporters as to expected yield per acre.

As a starting point in comprehending the system used in the United States it is important to have a clear understanding of what is meant by a "normal" condition and "par." The terms "normal" and "par," while related one to the other and frequently used inter-changeably, have, in fact, distinct meanings. Normal condition refers to a concept or picture exist-

ing in the mind of the crop reporter, while crop par refers to the mathematical interpretation placed upon this mass concept of the reporters by the statisticians of the Department after a comparison with crop yields.

Normal Condition is That Which Promises a Full Crop.

Briefly, normal condition is synonymous with full condition, giving promise of a full yield per acre. Condition refers to the status of the crop in comparison with normal growth and vitality for a particular date. The individual crop reporter compares the present appearance (state of growth, healthfulness, freedom from disease, tilth of soil, etc.) of the crop with his mind picture or concept of how the crop should look at this time to yield a normal or full crop. He reports the former as a percentage of the latter. In other words, the normal is taken as a base, or 100 per cent. The reporter's concept of normal condition is a composite picture based upon his entire experience. He keeps in mind each year two things, —a full crop and the condition on each date which he feels will bring a full crop. With a slight allowance for trend he has in the normal condition a stable base or measuring stick.

In instructions to reporters and articles appearing in the Monthly Crop Reporter from time to time the following description of a normal condition has been given:

To begin with, a normal condition is not an average condition, but a condition above the average, giving promise of more than an average crop. Furthermore, a normal condition does not indicate a perfect crop, or a crop that is or promises to be the very largest in quantity and the very best in quality that the region reported upon may be considered capable of producing. The normal indicates something less than this, and thus comes between the average and the possible maximum, being greater than the former and less than the latter. The normal may be described as a condition of perfect healthfulness, unimpaired by drought, hail, insects, or other injurious agency, and with such growth and development as may be reasonably looked for under these favorable conditions.

While a normal condition is but rarely reported for the entire corn, wheat, cotton, or other crop area, at the same time or in the same year, its local occurrence is quite common. The tendency of reporters when a crop is normal or above is to understate the conditions, as there seems to be an instinctive

objection on the part of reporters to report more than 100 at any time. This factor must be taken into consideration in interpreting condition reports.

Reporters Understand the Term "Normal."

The normal as used by the Department of Agriculture has been criticized by several eminent statisticians on the ground that it has no definite statistical basis and therefore by itself cannot convey any meaning. It has been found, however, that the crop reporter has a well defined judgment of what constitutes a normal for his locality. Moreover, the normal has been found to be a very stable figure. This is evidenced by the agreement in the returns received by the Department from its two major independent sources,—the township reporters, who report direct to Washington, and the field aids, who report to the agricultural statisticians in each State. The extent to which these agree is shown below for the corn condition estimates of 1922:

Frequency Distribution Showing Difference Between Estimates of Two Principal Reporting Lists for Condition of Corn in 1922.

| Difference | Number of States ¹ in which given difference was shown | | | |
|-------------------|---|----------|-------------|-----------|
| | July 1 | August 1 | September 1 | October 1 |
| 0 ----- | 8 | 4 | 6 | 6 |
| 1 point----- | 9 | 14 | 14 | 16 |
| 2 " ----- | 7 | 8 | 5 | 9 |
| 3 " ----- | 9 | 6 | 6 | 2 |
| 4 " ----- | 7 | 4 | 2 | 4 |
| 5 " ----- | 2 | 1 | 4 | 1 |
| 6 " ----- | 1 | 2 | 3 | 1 |
| 7 " ----- | -- | 2 | 1 | 2 |
| 8 " ----- | -- | 1 | 2 | 1 |
| 9 " ----- | -- | -- | -- | 1 |
| 10 to 16 points - | 3 | 2 | 2 | 2 |

It will be noted that in nearly one-half the cases differences of two points or less occur. The divergencies of four points or more occur mostly in States where the corn crop is of minor importance.

¹ Field aid data missing for a few Western States.

Reporters Experience Difficulty in Using "Average" as Base

It has been suggested that condition be reported in terms of a percentage of an average crop. The use of a concept of condition based upon the "average" would, however, present considerable difficulty to the reporter. First he would be compelled to recall the appearance of the crop on a certain date in each of a number of past years, and arrive at an average picture of these appearances. Secondly, he would be compelled to recall the yield in the corresponding years and arrive at an average of these yields. For both appearance and yield his picture would undoubtedly be dominated by a few years in the immediate past. Consequently, his concept of the relation between appearance and yield would be limited to a short time, rather than a long time, average. Because of the wide fluctuations in appearance and yield in a short time average, his base from year to year would be fluctuating and unstable.

The effect of the tendency of reporters not to report over 100 per cent would be greatly accentuated when the average is used as a base. By the very definition of an average, about one-half of the items of a series fall above it, while few fall above the normal as defined.

The experiences of at least one country (Norway) which uses the average as a basis of measurement indicates that the farmer really makes his comparison with the normal rather than with the average. Such reports, when applied on the basis of an average, indicate yields which fall below the final average yields.

Fixed Normal Offers No Advantages.

It has also been suggested that the normal should be definitely established or fixed for the reporters' use as a basis in estimating. The difficulty with this method is that it would attempt to impose upon the mind of the reporter a conception that would conflict with the facts for his locality with resulting confusion of thought. A normal fixed by the Agricultural Department would be subject to the bias of judgment of one or a few men, inflexible to changing conditions, if fixed permanently, and dangerously flexible if subject to alteration at will. It would furthermore require each reporter to make a careful mathematical calculation, with the consequent danger of error.

As a matter of fact from a mathematical standpoint exactly the same results are secured from the present plan of having no fixed normal that would result from the use of fixed normals. This is illustrated by the following example: Supposing in a certain county in Iowa there are seven reporters each of whom has a different concept of what constitutes normal, their concepts being influenced by their immediate surroundings. In the table shown below, the yields per acre as indicated by each reporter when condition estimates of 50, 60, and 70 per cent are made, are given; also the condition which each should report were a fixed par of 50 bushels per acre given each reporter as a standard:

| Reporter | Individual Reporter's concept of normal | Yield indicated from reporter's concept of par when condition is given at: | | | Condition which reporter should give if asked to compare to a par of 50 bushels | | |
|-----------------|---|--|-----------|-----------|---|----------|----------|
| | Yield per acre Bushels | 50 Bu. | 60 Bu. | 70 Bu. | Per cent | Per cent | Per cent |
| A----- | 35 | 17.5 | 21.0 | 24.5 | 35 | 42 | 49 |
| B----- | 40 | 20.0 | 24.0 | 28.0 | 40 | 48 | 56 |
| C----- | 45 | 22.5 | 27.0 | 31.5 | 45 | 54 | 63 |
| D----- | 50 | 25.0 | 30.0 | 35.0 | 50 | 60 | 70 |
| E----- | 55 | 27.5 | 33.0 | 38.5 | 55 | 66 | 77 |
| F----- | 60 | 30.0 | 36.0 | 42.0 | 60 | 72 | 84 |
| G----- | 65 | 32.5 | 39.0 | 45.5 | 65 | 78 | 91 |
| Average---- | 50 | 25.0 | 30.0 | 35.0 | 50 | 60 | 70 |
| Indicated yield | -- | --- | --- | --- | 25.0 | 30.0 | 35.0 |

It will be noted from the above that notwithstanding the fact that each reporter had a different standard of normal, identical indicated yields per acre would be secured from the present method with those secured if a fixed normal had been established. The above illustration covers a situation where the *condition* is assumed to be identical. A further example illustrates a situation where the *probable yield* is identical. Let us assume that three farmers are reporting for the same area, and that during four years, the crop promised 10, 20, 30, and 40 bushels per acre. The three reporters each using his own standard of comparison (normal yield) would report as follows:

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| Farmer | Concept of normal yield Bushels | Condition reported in successive years | | | |
|--|---------------------------------------|--|---------------|---------------|---------------|
| | | 1 Per cent | 2 Per cent | 3 Per cent | 4 Per cent |
| A----- | 20 | 50 | 100 | 150 | 200 |
| B----- | 30 | 33 | 67 | 100 | 133 |
| C----- | 40 | 25 | 50 | 75 | 100 |
| Sum----- | 90 | 108 | 217 | 325 | 433 |
| Average----- | 30 | 36 | 72 | 108 | 144 |
| Indicated yield (average concept times condition) | | 10.8 | 21.6 | 32.4 | 43.2 |

The relation of the averages is seen to be exactly what the farmers had in mind, the crop the second year being twice that of the first, the third three-fold, and the fourth four-fold.

The actual yield indicated is seen to run slightly above the figure in our example. The wide range in the conception of normal taken for the purpose of the illustration exerts a weighting influence whereby undue emphasis is given to the higher condition estimates. In actual practice the concept of the normal has a shorter range and a pronounced mode. As the par or equivalent 100 per cent yield is derived from the relation of condition to yield in past years, Y/C , instead of being fixed a priori, as in the example, it does not affect the result which reflects with mathematical exactness the relations of the crop yields of the successive years as they exist in the minds of the reporters.

Present Method Discounts Bias.

In monthly reports of crop conditions (in percentages of normal) it makes little or no difference whether or not there is a bias in the reporters' estimates, provided such bias is constant. This is because the value of condition estimates lies wholly in their relativity, and in comparison the bias is neutralized and practically disappears. An example will make this clear. Suppose the condition estimate is always 10 per cent too high, that is, a bias upward of 10 per cent; suppose also that the true condition of a crop last year be 100 per cent, and the true condition this year be 50 per cent. The *reported* condition would be 110 per cent last year and 55 per cent this year. Under either method, the true or the biased, the condition this year is shown to be just half as good as last year, 50 being half of 100, and 55 being half of 110. Therefore such bias, if constant, does no harm.

*Early Season Condition Reports Show Less Dispersion Than
Estimates of Expected Yield.*

It has occasionally been suggested that the reporters should be asked the direct question as to the expected or probable yield per acre indicated by conditions at the time of the inquiry. Several experiments were made by the former chief statistician of the service, Mr. Nat C. Murray, to determine the merit of the suggestion. An examination of the returns showed a much less dispersion in the percentage estimates than in the yield per acre estimates, the dispersion in the former being only about one-half that of the latter. In commenting on the reasons why the dispersion is less in the case of percentage estimates than in the case of yield per acre estimates, Mr. Murray said:

"The average yield per acre of any county is made up of a wide diversity of individual acre yields. Some fields under 'favorable' conditions may produce 70 bushels per acre, and other fields, under equally favorable seasonal conditions, may produce only 30 bushels per acre, owing to naturally thinner soil or poorer farming methods. The seasonal conditions which affect crop growth are much more uniform throughout a county. If one field produces 70 bushels in one year and 50 the next, it is more likely than not that the poorer field, which produced 30 bushels the first year, will produce less in the second year in the same proportion as the better field produced less the second year than the first.

"An additional reason for such diversity is the fact that it is easier to estimate the ratio of the two quantities than to estimate the quantities themselves; it is easier to estimate the ratio of present condition to normal condition than to estimate the number of bushels indicated by present conditions or by normal conditions; just as it is easier to estimate the percentage of full jar, of a partially filled jar of beans, than to estimate the number of beans in the jar."

The experiments were made early in the season, and while the writers agree that better results are secured by using the percentage method early in the season, they feel that when a crop approaches maturity, as for example, when grain has reached the dough stage, there is considerable merit in the suggestion that fully as accurate results might be secured by asking the direct question as to expected yield. Experiments are now being made in the Department with a view to getting more information on this point.

Crop Pars are Interpreted from Past Condition and Yield.

The next step in the work of forecasting is that of interpreting the condition figure into a probable yield per acre. This is done by the means of a mathematical interpretation of condition figures and the establishment of what the Department calls "pars" or the equivalent of 100 per cent.

At the close of the season the reporter gives his estimates of yield per acre. It is upon the comparison between the farmer's report on condition and his reports on yield that crop pars are based. To determine what yield per acre the reporter had in mind when he reports a 90 per cent condition this month, and year, it is necessary to know what yield per acre resulted from such a condition on an average in the past.

The Iowa corn computation sheet shown below illustrates the method of determining crop pars:

Par Computation Sheet for Iowa Corn

Section A

| | Condition (per cent of normal) on first of month | | | | Yield Per acre | Equivalent of 100%, Y/C (Computed) | | | |
|------|---|--------|----------------|---------|----------------------|---------------------------------------|--------|----------------|---------|
| | July | August | Sep- tember | October | | July | August | Sep- tember | October |
| 1907 | 78 | 78 | 76 | 70 | 30.5 | 39.1 | 39.1 | 40.1 | 43.6 |
| 1908 | 83 | 83 | 80 | 80 | 31.7 | 38.2 | 38.2 | 39.6 | 39.6 |
| 1909 | 86 | 85 | 79 | 77 | 31.5 | 36.6 | 37.1 | 39.9 | 40.9 |
| 1910 | 84 | 80 | 82 | 86 | 36.3 | 43.2 | 45.4 | 44.3 | 42.2 |
| 1911 | 98 | 68 | 68 | 70 | 31.2 | 31.8 | 45.9 | 45.9 | 44.6 |
| 1912 | 83 | 89 | 93 | 91 | 43.0 | 51.8 | 48.3 | 46.2 | 47.3 |
| 1913 | 89 | 85 | 76 | 77 | 34.0 | 38.2 | 40.0 | 44.7 | 44.2 |
| 1914 | 100 | 91 | 81 | 84 | 38.0 | 38.0 | 41.8 | 46.9 | 45.2 |
| 1915 | 74 | 72 | 65 | 63 | 30.0 | 40.5 | 41.7 | 46.2 | 47.6 |
| 1916 | 80 | 84 | 82 | 83 | 36.5 | 45.6 | 43.5 | 44.5 | 44.0 |
| 1917 | 86 | 87 | 82 | 80 | 37.0 | 43.0 | 42.5 | 45.1 | 46.2 |
| 1918 | 97 | 95 | 83 | 83 | 36.0 | 37.1 | 37.9 | 43.4 | 43.4 |
| 1919 | 87 | 87 | 89 | 90 | 40.0 | 46.0 | 46.0 | 44.9 | 44.4 |
| 1920 | 90 | 94 | 90 | 93 | 43.3 | 48.1 | 46.1 | 48.1 | 46.6 |
| 1921 | 102 | 92 | 92 | 91 | 42.0 | 41.2 | 45.7 | 45.7 | 46.2 |
| 1922 | 91 | 94 | 94 | 96 | 45.0 | 49.5 | 47.9 | 47.9 | 46.9 |

Section B—Ten-year moving average, Y_{10}/C_{10}

| | | | | | | | | | |
|-------|------|------|------|------|-------|-------|-------|-------|-------|
| 07-16 | 85.5 | 81.5 | 78.2 | 78.1 | 34.15 | 40.15 | 41.94 | 43.67 | 43.74 |
| 08-17 | 86.3 | 82.4 | 78.8 | 79.1 | 34.90 | 40.67 | 42.41 | 44.30 | 44.15 |
| 09-18 | 87.7 | 83.6 | 79.1 | 79.4 | 35.33 | 40.56 | 42.38 | 44.68 | 44.53 |
| 10-19 | 87.8 | 83.8 | 80.1 | 80.7 | 36.18 | 41.50 | 43.27 | 45.18 | 44.88 |
| 11-20 | 88.4 | 85.2 | 80.9 | 81.4 | 36.90 | 42.01 | 43.37 | 45.59 | 45.35 |
| 12-21 | 88.8 | 87.6 | 83.3 | 83.5 | 37.98 | 42.95 | 43.35 | 45.57 | 45.51 |
| 13-22 | 89.6 | 88.1 | 83.4 | 84.0 | 38.18 | 42.72 | 43.31 | 45.74 | 45.47 |

Section C—Five-year moving average, Y_5/C_5

| | | | | | | | | | |
|-------|------|------|------|------|-------|-------|-------|-------|-------|
| 12-16 | 85.2 | 84.2 | 79.4 | 79.6 | 36.30 | 42.82 | 43.06 | 45.70 | 45.66 |
| 13-17 | 85.8 | 83.8 | 77.2 | 77.4 | 35.10 | 41.06 | 41.90 | 45.48 | 45.44 |
| 14-18 | 87.4 | 85.8 | 78.6 | 78.6 | 35.50 | 40.84 | 41.48 | 45.22 | 45.28 |
| 15-19 | 84.8 | 85.0 | 80.2 | 79.8 | 35.90 | 42.44 | 42.32 | 44.82 | 45.12 |
| 16-20 | 88.0 | 89.4 | 85.2 | 85.8 | 38.56 | 43.96 | 43.20 | 45.20 | 44.92 |
| 17-21 | 92.4 | 91.0 | 87.2 | 87.4 | 39.66 | 43.08 | 43.64 | 45.44 | 45.36 |
| 18-22 | 93.4 | 92.4 | 89.6 | 90.6 | 41.26 | 44.38 | 44.72 | 46.00 | 45.50 |

Section D—(Adopted pars)

| | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| 1917 | ---- | ---- | ---- | ---- | ---- | 41.0 | 43.0 | 45.0 | 45.0 |
| 1918 | ---- | ---- | ---- | ---- | ---- | 41.0 | 42.5 | 45.0 | 45.0 |
| 1919 | ---- | ---- | ---- | ---- | ---- | 41.0 | 42.0 | 45.0 | 45.0 |
| 1920 | ---- | ---- | ---- | ---- | ---- | 42.0 | 43.0 | 45.0 | 45.0 |
| 1921 | ---- | ---- | ---- | ---- | ---- | 42.5 | 43.2 | 45.2 | 45.2 |
| 1922 | ---- | ---- | ---- | ---- | ---- | 43.0 | 43.5 | 45.4 | 45.4 |
| ---- | ---- | ---- | ---- | ---- | ---- | 43.5 | 44.0 | 45.5 | 45.5 |

It will be noted that the reporters gave for 1922 (Section A) condition figures for July 1, August 1, September 1, and October 1, respectively of 91 per cent, 94 per cent, 94 per cent, and 96 per cent, of normal. The final yield per acre is given as 45.0 bushels. Accordingly, in 1922, the resultant equivalents of 100 per cent (or par) were respectively:

| | | | | |
|------|------|------|------|---|
| 45.0 | 45.0 | 45.0 | 45.0 | |
| — | — | — | — | , or 49.5, 47.9, 47.9, and 46.9 bushels |
| 91 | 94 | 94 | 96 | |

per acre.

In like manner, the resultant pars for the 1921 crop were respectively, 41.2, 45.7, 45.7, and 46.2 bushels per acre.

Similar data are shown for each year back to 1907.

Under Section B are shown series of ten-year averages of condition, yield, and resultant pars; under Section C, a series of five-year averages. These series show the ten-year and five-year trends of condition, yield, and resultant pars.

The pars adopted for forecasting yields per acre are shown under Section D. These are determined by the statistician after an inspection of Sections A, B, and C. Consideration is given to the trends (projected), to the median par under Section A, to any unusual relations of unusually high or low yields coupled with average condition, or vice-versa, or to any tendency for unusually high or low yields to be "bunched" in recent years. Attention is called to the fact that the adopted par is not Y_{10}/C_{10} , nor Y_5/C_5 , nor Y_m/C_m , but a figure selected after a consideration of all three ratios.

It will be noted that both the five-year and ten-year average resultant pars for October are 45.5 bushels (when projected approximately 46.2 and 46.8), the median of the 15 year period 1908-1922 is 45.2 bushels, and the median of the past 7 years, 46.2 bushels. The par accepted for use in October, 1923, was 45.5 bushels. The pars adopted for use in the other months are determined in like manner. The pars adopted are somewhat below the projected moving averages, because of the "bunching" of high yields during the past 4 years. It will be noted that the pars as used assume a linear or straight line relationship between condition and yield. The tendency of reporters previously mentioned, not to report above 100, results in a non-linear relationship when the yield is high.

A similar non-linear relationship has been noted when the yield is extremely low. In the first case, the condition figures reported are low relative to yield; in the second case, high relative to yield. Allowance must be made in the current estimate to correct to a linear basis.

This tendency is shown by further illustration from the Iowa figures. When the secular trend is eliminated from both condition and yield and all the estimates corrected to a 1922 base the following comparisons result:

| | Average Condition | Average Yield | Computed 100% equivalent |
|-----------------------------|----------------------|------------------|-----------------------------|
| Condition of 95 and over-- | 97.5 | 46.1 | 47.2 |
| Condition of 94 and under-- | 87.2 | 40.4 | 46.4 |

It will be noted that in the first group a high equivalent results from the understating of conditions.

For the majority of crops the condition declines on an average from month to month as the season advances. This is the natural result of the vicissitudes through which the crop must pass and for which the reporter cannot make due allowances. He reports the crop as it appears at each date and takes into consideration all of the existing factors known to him which have an influence upon the final yield. Because the future unfavorable factors are not fully discounted by the reporter, earlier months have a higher average reported condition than the later months, and a lower computed par. The factor of future influences upon the crop cannot be fully discounted by the reporter. He makes a partial allowance based upon his experience of the declining condition of the crop in successive months. But the unforeseen future influences tend downward more often than upward, and the magnitude of the downward change is on the average greater than that of the upward changes. Thus, a condition of 100 will not infrequently fall to 50, and it may fall to 0, but it will rarely rise as much as 20 points. The 10-year average condition of corn in Iowa decreases 5.6 points from July 1 to October 1; the 10-year resultant par consequently increases from 42.7 bushels to 45.5 bushels. (Section B.)

In its application to the current year, this relationship frequently results in a *decrease* in the reported condition accompanied by an *increase* in the forecasted yield per acre. In

the illustration here used the condition in the current year must decline more than 4.6 per cent (45.5—43.5) /43.5 before a decline in the forecast results. Should the condition decline less than 4.6 per cent, increase, an increase in the forecast would occur.

The following table indicates the yield of corn in Iowa which were forecast and final yields as estimated each year, based on the reporters' estimates of average yield per acre in bushels after the harvest was completed:

Iowa Corn

| Year | July | August | September | October | Nov. (yield) |
|--------|------|--------|-----------|---------|--------------|
| 1914-- | 39.5 | 38.7 | 35.6 | 37.0 | 38.0 |
| 1915-- | 29.6 | 31.0 | 28.9 | 27.9 | 30.0 |
| 1916-- | 32.0 | 36.1 | 36.9 | 37.4 | 36.5 |
| 1917-- | 35.2 | 37.4 | 36.9 | 36.0 | 37.0 |
| 1918-- | 39.8 | 40.4 | 37.4 | 37.4 | 36.0 |
| 1919-- | 35.7 | 36.5 | 40.0 | 40.5 | 40.0 |
| 1920-- | 37.8 | 40.4 | 40.5 | 41.8 | 43.3 |
| 1921-- | 43.4 | 39.7 | 41.6 | 41.1 | 42.0 |
| 1922-- | 39.1 | 40.9 | 42.7 | 43.6 | 45.0 |
| 1923-- | 39.6 | 39.6 | 40.5 | --- | --- |

In the determination of pars for cotton, allowance must be made for probable damage due to boll weevil. A study of the changes in 100 per cent equivalents in States fully invaded for a term of years indicates that the reporter in early season reports does not make adequate allowance for the probable boll weevil damage. From the records it appears that after about three years experience with this insect, he begins to discount the present appearance in terms of probable deterioration from this cause. To properly allow for boll weevil damage, it has been found necessary to adopt relatively low pars for the early forecasts on cotton, in the States of more recent invasion.

Regression Equations Comparable with Present Method.

It has been suggested that forecasts be made from regression equations based upon condition correlated with yield per acre with trend eliminated. A study of this kind has been made for a few crops for a few States. In some instances, it appears that the correlation method is superior to the

method of pars; in some instances inferior, while in the majority of cases there is little to choose between the two methods. Attention is directed to the fact that the use of correlation methods is rendered difficult by the non-linear regression at the two extremes of the data. Generally speaking, there is a high degree of correlation between crop condition and final yield for the later months, lower degrees for the earlier months. For the Iowa data given, the co-efficients, beginning with July 1, were $.117 \pm .164$; $.599 \pm .124$; $.907 \pm .031$, and $.921 \pm .026$.

The low correlation shown for the month of July illustrates the difficulty of making estimates at this early date for some of the Northern States. Consideration is being given to the advisability of using the five-year average in lieu of the probable yield based upon par where the correlation is low.

Extensive Study Needed of the Relation of Weather to Yield.

The problem is also being approached from an entirely different angle. Each method so far outlined requires the individual crop reporter to interpret the effect of weather conditions upon yield. Preliminary work is now under way to measure mathematically the relationship between early growing season weather conditions and final yields. The methods are necessarily complicated, owing to the large number of weather factors which affect yield, but in general they are an extension of the correlation method. In the preliminary work on cotton yields several indices for individual States have been constructed which forecast yield by two or three months and correlate with the final yield as high as .975. The United States Weather Bureau has made some progress in this direction and the relation of weather factors to yields have been studied by several private investigators. The results so far obtained are sufficiently promising to justify much more extensive investigation than has been attempted heretofore.

ON THE USE OF PARTIAL CORRELATION IN THE ANALYSIS OF FARM MANAGEMENT DATA

By MORDECAI EZEKIEL

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During recent years many workers in the field of farm management have come to feel that there is room for improvement in the use of the "labor income" method of studying farm organization. Attention has been focused upon the need of some index of success which would measure the relative success of different farmers more accurately than the original labor income figure. Per cent earned on investment, "labor earnings," and various other ways of measuring success have been suggested. There has been much valuable discussion on this point, and it may be confidently expected that some improved measure of success will soon be in use.¹

After reaching some conclusion as to the best way to measure the success of each farmer, there is still room for improvement in the way in which the statistical analysis is carried out. The financial success or failure of a given farm in a given year is due not only to the correct adjustment of the farm enterprises to economic conditions at the time, but to the ability with which the farmer conducts the day-to-day management of the farm—efficiency in feeding stock, in utilizing man-labor, in "keeping things moving"—and to his ability in bargaining. Further, it cannot be assumed that the conditions that prevailed the year of the survey will be true of subsequent years; hence the analysis should take account of the special conditions which prevailed that year, both as to weather conditions and yields and as to economic conditions and prices; the "historical" conditions must be taken into account. Furthermore, as has been recently pointed out by C. C. Taylor², the usual analysis of organization data has been defective in that it failed to take account of the large number of different factors which together affect the final income figure, and instead imputed to each

¹ Conference of Research Workers in the Field of Farm Organization and Cost of Production, U. S. Department of Agriculture, Bureau Agricultural Economics, mimeographed report, July, 1923. Report of Committee on Use of the Survey Method in Studying Farm Organization Problems.

² A Statistical Analysis of Farm Management Data, *Journal of Farm Economics*, Vol. V, No. 3, pp 153-162, July, 1923.

factor in turn results which were really due not only to that factor but to the others correlated with it. In view of this multiplicity of factors, multiple correlation has been suggested as a way to obtain valid results.

This present paper will be confined to a discussion of analytical methods, leaving aside the question of the best way of computing the index of success.

The analysis of the results of a given survey must take into account (1st) the setting of the survey as to economic and biologic conditions—must relate the conditions at the time and place surveyed both to usual conditions and to reasonable variations from the usual; (2nd), the variations in farm practice from farm to farm in so far as they can be measured, determining the effects of variations in the efficiency of the farm operator and making adjustments for them in the subsequent analysis; (3rd), the combination of enterprises, taking into account limiting conditions—size, stock, etc. Finally, the entire analysis must be so conducted that effects really due to one cause are not imputed to another.

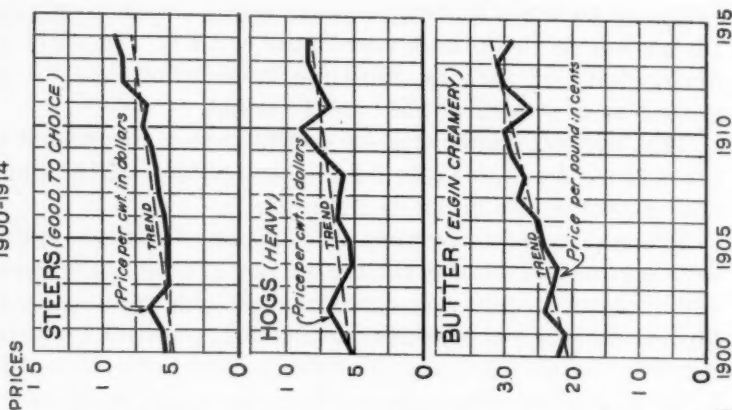
Farm survey data covering 965 farms in Blackhawk, Tama, and Grundy Counties, Iowa, for the year 1913 are used to illustrate the application of these principles.¹ This area is a typical corn belt section, with corn, oats, and hay as the principal crops, and hogs and beef cattle as the leading live stock.

Figure 1 gives the average yields and prices of the principal Iowa crops from 1900 to 1914. Using straight lines as very rough indications of the trends in yields and prices over this period, it is evident that 1913 was a very favorable year for corn and hay, that oats were about usual, and that barley was below usual. Figure 2, giving the average value of these crops per acre, shows the combined effect of yields and prices more definitely. Corn was worth about one-sixth more per acre than usual, and hay about one-quarter more, while oats were just about as usual, with barley decidedly below expected values.²

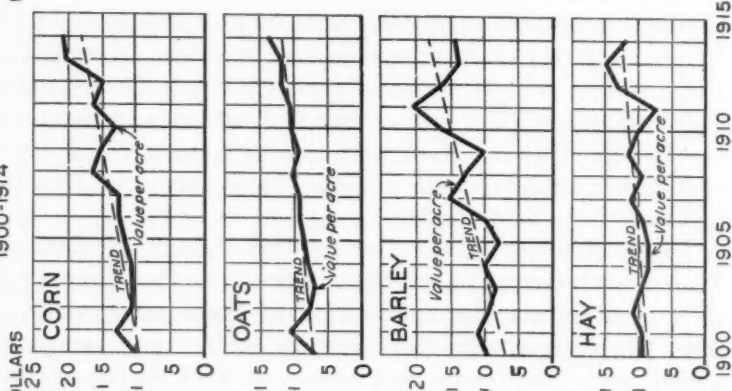
¹ Data obtained cooperatively by the Iowa Agricultural Experiment Station and the U. S. Department of Agriculture. The regular analysis was published as Iowa State College Experiment Station Bulletin 198, H. B. Munger.

² This is assuming that conditions in the area surveyed followed general conditions in the state. It would be better to base these conclusions upon historical data for the counties surveyed if reliable data could be obtained.

PRICES OF PRINCIPAL IOWA LIVESTOCK
PRODUCTS ON THE CHICAGO MARKET
1900-1914



VALUE PER ACRE OF
PRINCIPAL CROPS IN IOWA
1900-1914



YIELDS AND PRICES OF
PRINCIPAL CROPS IN IOWA
1900-1914

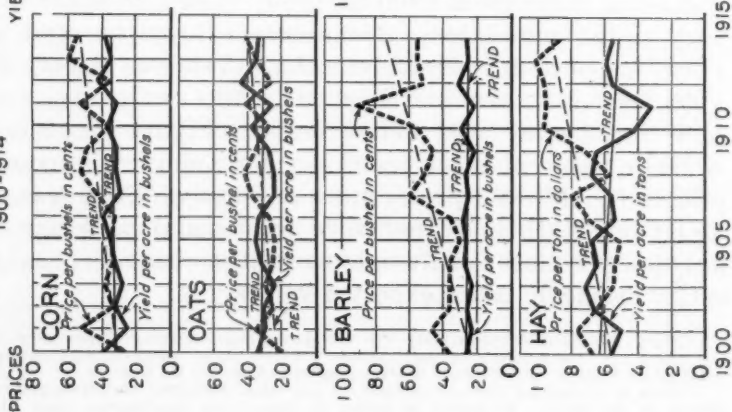


Figure 3 gives similar figures for the value of live stock and products. Butter and hogs were at just about normal prices, while beef cattle were worth slightly more than usual. However, since this same situation had prevailed for beef the previous year, and therefore would have applied to feeders purchased as well as fat cattle sold, it is probable that the results of feeding beef cattle represented little if anything above usual returns.

From this brief survey it appears that in this area 1913 was about usual with regard to the significance of returns on live stock enterprises, but was unusually favorable for corn and hay, and unfavorable for barley.¹

Owing to the necessity of using old material, no data were available as to specific variations in farm practices on these different farms, hence this phase of the analysis could not be taken into account.

The usual "sorting" factors were used in partial correlation analysis of the data. If this analysis alone could satisfactorily separate the real effect of each factor upon income, the more factors that were included the better the results would be. Hence sixteen individual factors, all the important ones in the data available, were used in the analysis, as well as the resultant factor, labor income.

Table I presents the coefficients of net (or partial) correlation between each of the sixteen "causal" factors included. The briefest examination of these results indicates at once the fallacy of sorting and subsorting on two or three variables, and assuming that the effects of all other factors on the results will "average out." Many of the variables are highly correlated with from eight to twelve of the other factors; results obtained by sorting on these variables would be partly due to the other correlated factors.

Before discussing the individual significance of each of these inter-correlations it is necessary to have a clear and definite impression of what each variable means.

Total acres and acres in crops are clear. Productive animal units, though generally accepted, is not very definite;

¹ The methods of determining "usual" conditions used here are very rough. Elimination of changes in the general price level and fitting accurate trend lines by more complex methods (the method of semi-averages was used here) would give more exact results.

Table I—Coefficients of Net Correlation Between Each Pair of Sixteen Variables, 965 Farms, Iowa: 1913

(With effect of other fourteen eliminated in each case)

| VARIABLES CORRELATED | Acres in Crops | Productive Animal Units | Months of Man Labor | Total Capital | Working Capital % of Total | Per cent. of Area in | | | Per cent. of Receipts from | | | | Crop Acres per horse | Livestock Index | Crop Index |
|---|--------------------|-------------------------|---------------------|---------------|----------------------------|----------------------|--------------|-----------------|----------------------------|--------|--------------------|-------|----------------------|-----------------|------------|
| | | | | | | Corn | Small Grains | Hay and Pasture | Dairy Products | Cattle | Swine | Crops | | | |
| Total Acres..... | + .13 ¹ | — .04 | + .21 | + .65 | + .43 | + .42 | + .51 | + .47 | — .12 | — .45 | — .21 | + .10 | + .50 | — .15 | — .45 |
| Acres in Crops..... | | + .52 | + .51 | — .07 | — .38 | — .43 | — .41 | — .45 | — .16 | — .15 | — .14 | + .25 | + .32 | + .09 | — .15 |
| Productive Animal Units..... | | | — .70 | + .59 | + .80 | + .76 | + .74 | + .75 | + .32 | + .15 | + .33 | — .25 | — .10 | — .29 | + .04 |
| Months of Man Labor..... | | | | + .34 | + .49 | + .46 | + .46 | + .44 | + .30 | + .19 | + .24 | — .22 | — .36 | — .15 | + .11 |
| Total Capital..... | | | | | — .80 | — .73 | — .74 | — .75 | — .11 | + .36 | + .00 ² | + .03 | — .32 | + .22 | + .39 |
| Working Capital—per cent. of total capital..... | | | | | | — .93 | — .93 | — .94 | — .14 | + .28 | — .04 | + .14 | — .25 | + .27 | + .17 |
| Per cent. of Area in Corn..... | | | | | | | — .99 | — .99 | — .15 | + .25 | — .03 | + .21 | — .21 | + .26 | + .11 |
| Per cent. of Area in Small Grains..... | | | | | | | | — .99 | — .14 | + .27 | — .01 | + .19 | — .21 | + .24 | + .12 |
| Per cent. of Area in Hay and Pasture..... | | | | | | | | | — .14 | + .29 | — .00 ² | + .18 | — .22 | + .24 | + .13 |
| Per cent. of Farm Receipts from Dairy Products..... | | | | | | | | | | + .43 | — .55 | — .24 | + .03 | + .41 | — .18 |
| Per cent. of Farm Receipts from Cattle..... | | | | | | | | | | | — .62 | — .26 | + .39 | + .12 | — .29 |
| Per cent. of Farm Receipts from Swine..... | | | | | | | | | | | | — .38 | + .09 | + .48 | — .25 |
| Per cent. of Farm Receipts from Crops..... | | | | | | | | | | | | | — .02 | — .10 | + .13 |
| Crop Acres per Horse..... | | | | | | | | | | | | | | + .38 | + .08 |
| Livestock Index..... | | | | | | | | | | | | | | + .26 | + .26 |
| Crop Index..... | | | | | | | | | | | | | | | |

¹ With a sample of 965 cases, the probable error for a coefficient of correlation of 0.00 would be $\pm .022$. For this reason, the probable error of the different coefficients is not shown; any coefficient of .08 or larger may be considered to be due to other causes than chance.

² Coefficient with a value smaller than .005.

the feed basis for combining the different classes of stock may not be the best for all purposes. Months of man labor is a simple aggregate; some method of measuring labor distribution through the year would help to make it a better measure of labor input. Total capital, though outwardly innocuous, is a very unsatisfactory figure for correlation analysis. It embodies a large number of physical units—acres, cattle, horses, machinery, etc.—each multiplied by its own value-rate, and any interpretation of its significance may be obscured by the effects of these hidden components. The per cent which working capital is of total capital is equally troublesome, as it is but a very vague way of measuring differences in farm organization—working capital is itself a complex of many units.

The percentage distributions of farm area and of farm receipts would seem to be simple, easily-handled factors; but for reasons which will be explained later, they proved quite unsuitable for this type of analysis.

The miscellaneous factors included in the last group all proved to be really complex upon close examination. "Crop index" is a composite measure of the fertility of the land, the relative intensity of the cultivation, and the ability of the farmer. Live stock index measures the innate efficiency of the stock, the intensity of their feeding, the relative proportions of the different kinds of live stock, and the ability of the farmer. Crop acres per horse is of relatively little significance in view of the wide variations in the proportions of crops with very different demands for labor, such as corn and hay; further, it reflects size of the horses and ability of the operator, as well as size of farm. Other factors which have been used in farm management studies are found upon careful analysis to be open to similar objections. The partial correlation study based on the factors enumerated has furnished information for a critical analysis of their true significance, which may aid in more accurate use of interpretative "factors" in later studies.

The relation of total acreage to crop acres per horse is quite significant. Apparently even after the effects of the crop distribution and the other items are eliminated there remains

a definite tendency for farms with larger acreages of land to have also more crop acres per horse. Whether this is due to more efficient management on such farms, or merely to inherent advantages of size, remains to be determined by further analysis.

The crop index is found to have a distinct negative relation to total acreage (net $r = -.45$). This may be due to any of the following three conditions:

1. On the farms with the larger areas not in crops the soil was not as fertile. (Any correlation of total acreage with crop index due to total acreage including the crop acres, has been eliminated by the partial correlation method—crop acreage is one of the factors whose effect is now held constant. Hence we may interpret the correlations of total acreage as due to that part of its components which has not been eliminated—i. e., the acres *not* in crops.)

2. On the larger farms the culture of the different crops was less intense, and consequently the yields were lower.

3. On the larger farms the quality of the management was poorer.

Farms with higher proportions of area not in crops probably had rougher topography than the others, hence the first explanation seems the best, though the second one probably is partially true.

All of the inter-correlations of each of the sixteen variables deserve similar detailed consideration, but owing to the limitations of space only a few of the most interesting relations can be touched on.

Owing to the use of percentages, the coefficients for acreage distribution and receipts distribution present some peculiar features. On any given farm, the per cent of the whole area which is in corn, plus the per cent in small grains, plus the per cent in hay and pasture, plus the per cent not crop land, will equal 100. All of these factors except land not in crops were included in the computation. There is very little variation in this latter per cent on many of the farms, and as a result the only way that one of these percentages could be larger was by one of the others being smaller. This is shown by the practically perfect negative correlation between the three factors; when all other factors were held constant, the only way that one percentage could increase was by the

other one decreasing. But when the per cent in corn was correlated with, say, the total acres, then the mechanics of the net correlation method held constant not only acres in crops, the productive animal units, and so on, but also held constant the percentages in small grains and in grass (hay and pasture). As a result, the only way that the relative acreage in corn could increase at all was at the expense of the proportion not in crops or pasture. Similarly, the correlation of total acres with the per cent of land in small grains shows, not how strongly the area of small grains as such increases as the farm is larger, but how strongly it increases at the expense of the land not in crops as the farm size becomes larger.

Hence the interpretation of the acreage distribution must be made on a different basis from the interpretations previously made. Thus, taking total acres in crops again, its definite positive correlation with all three designated groups, corn, small grains, and hay and pasture, shows that, other things being the same, as the size of the farm increases the proportion of the area which is *not* in crops decreases. Comparing the size of each of the three coefficients further shows that the relative acreage in small grains is most closely related to size of farm, that in hay and pasture next, and that of corn least of all. In fact, were it not for the decrease of the proportion of land not in crops, the proportion in corn might even decrease as the farms become larger.

Strangely enough, the net effect of larger acreages of crops is smaller proportions of the area in corn, grain, and grass (including pasture, which is not one of the components of crop "acreage"). This probably shows that as the farm is larger, a larger proportion is in pasture as compared to harvested crops; this conclusion is substantiated by the negative relation being most strongly marked for per cent in hay and pasture.

There is a very high positive correlation of the acreage distribution factors with the number of productive animal units; apparently as the farm is more heavily stocked, it has less waste land—due probably both to utilization as to pasture and to better management. The pasture utilization is not the sole reason, as the increase in relative corn acreage is even more marked than that in hay and pasture acreage. As is to be expected, the increase of small grains is least important; but

for the mathematical limitation previously mentioned, it would probably be negative.

Similarly as man labor is applied more intensively the area of waste land is cut down; in this case, though, by reason of increasing small grain and corn acreage, rather than grass.

The positive relation to livestock index shows that on farms where there is least waste land the livestock is apt to be more productive. Here, again, the incommensurable—management—is probably the cause, the correlation being due to co-relationship rather than to causal relationship; this applies equally well to most of the other relations just gone over. Though in a less marked degree, the same tendency is evident for crop index—the better the management, the better the crops and the closer the utilization of the land.

Somewhat of the same complication interferes with the meaning of the correlations with the per cent of receipts from dairy, cattle, swine, and crops. In this case, the only other item of receipts not included in the computations was, in most cases, poultry products, though sheep and wool were represented occasionally. Hence, these results must be interpreted on a comparative rather than an absolute basis.

The negative relation of cattle receipts to total crop acres may indicate that as the acres not in crops increased, the receipts from poultry increased faster than the receipts from cattle. Similarly, the positive correlation with crop acres shows that as acres in crops increased, receipts from crops increased faster than receipts from poultry.

It is significant that both receipts from dairy products and from swine have a much higher net correlation with the number of animal units than has receipts from cattle. One animal unit in dairy cattle or swine has a much greater effect upon the receipts than one unit in beef cattle.

The relation to months of man labor show that both dairying and swine raising require more human labor than does feeding cattle. The correlations with crop acres per horse show the same thing—extensive use of horse labor goes with feeding cattle.

The relations of the receipt distribution factors to each other are of interest. Swine raising is an alternative to dairying or feeding more than to crop sales; while apparently dairying and cattle receipts have a tendency to increase together—probably due to selling veal calves and milking beef cattle to some extent.

The correlations of livestock index are of real value. They indicate that, when other things are held constant, the index is not equally responsive to all classes of livestock, but is more affected by some than by others. Thus both swine sales and dairy sales are strongly reflected in the index, but beef cattle productivity is only slightly reflected—the positive relation with beef cattle receipts being only barely higher than the negative relation with crop receipts. This is due to the fact that, as computed ordinarily, live stock index merely measures average returns per animal unit without regard to the proportion of the different classes of live stock, and hence is much more strongly affected by those classes of stock which have the largest output per animal unit. What is needed is an index which will measure the productivity of all the stock on the farm, independent of the composition of that stock. The proper adjustment of the different kinds of stock to the economic environment will thus be kept distinct from the proper adjustment of the production per head of stock.

The relations of per cent of receipts to crop index are not particularly noteworthy. Apparently farms with a larger proportion of receipts from stock tend to have poorer crop yields, but probably that is due to the fact that the farms with poor yields have less surplus to sell.

In addition to the relations already noted, crop acres per horse is noticeably correlated with livestock index. Apparently the same men who get good production from their other stock make the best use of their work stock. It is interesting to note that the relation between crop acres per horse and crop index is positive, though the coefficient is nearly nil. In other words, the men who use the least horse labor still do not decrease their yields—the better use of the work stock is due to more efficient management, not to slighting the crops.

As has already been indicated, the net relation of the crop and live stock indexes to most of the factors must be taken as evidence of a common causal relation with efficiency of management, rather than any causal relationships among the factors stated. This is further shown by the correlation of crop-index with live-stock index—those men who have the best crop production tend to have the best livestock production. There seems to be little other causal relation involved.

This detailed discussion of the inter-relation between the different factors has brought out but little new information, but it has served to better explain the exact significance of each of the factors used in this study, and to prepare the way for the discussion of the net relation of each of the different factors to the factor of most interest—labor income.

Factors Determining Labor Income.

Correlating the sixteen "causal" factors with labor income, the multiple correlation was $R = .744 \pm .081$. The average relation between each of the factors considered and labor income, and the closeness of the relation, is given in Table II.

The multiple correlation of .74 indicates that there are many other factors affecting labor income besides those included in this study. The variations in the efficiency of farm practice on individual farms, the variations in bargaining efficiency, and differences in native ability of the farmers themselves, all affect the income. Furthermore, the factors used were not the best that could be devised. A perfect study would reveal the factors affecting labor income so accurately that the multiple correlation would be 1.00; that is the goal toward which we must work.

Table II—Net relations of each of 16 factors to Labor Income, eliminating the effect of the other 15 (965 farms, Iowa, 1913)

| On the average, each additional | Increased Labor income ¹ | Closeness of the Relation Coefficient of net correlation ² |
|---|-------------------------------------|---|
| Acre in crops..... | \$12.33 | + .319 |
| Acre not in crops..... | 4.81 | + .044 |
| Productive animal unit..... | — 4.21 | — .039 |
| Month of man labor..... | —51.88 | — .275 |
| Hundred dollars of capital..... | — 3.62 | — .188 |
| Per cent of working capital (of total capital)..... | 125.87 | + .141 |
| Per cent of area in corn..... | 120.73 | + .185 |
| Per cent of area in small grain..... | 111.16 | + .154 |
| Per cent of area in hay or pasture..... | 108.03 | + .152 |
| Per cent of receipts from dairy products..... | — 5.76 | — .091 |
| Per cent of receipts from cattle..... | —16.68 | — .167 |
| Per cent of receipts from swine..... | —13.54 | — .188 |
| Per cent of receipts from crops..... | — 2.49 | — .047 |
| Crop acre per horse..... | — 7.55 | — .085 |
| Point on livestock index..... | 17.99 | + .528 |
| Point on crop index..... | 17.92 | + .300 |

¹ The minus sign (—) denotes decrease.

² The P. E. for a coefficient of $r = 0$ would be $\pm .022$; hence any coefficient of .08 or larger may be considered to be due to other causes than chance.

The labor incomes on these 965 farms ranged from a loss of nearly \$4,000 to over \$4,000 gain, covering a total range of about \$8,000. If the labor income for each farm were

estimated from the 16 causal factors studied, half of these "predicted" values would lie within \$300 of the actual figures, and two-thirds of them within \$440 of the actual figures. This gives a concrete idea of the extent to which these 16 factors determine labor income.

The most important factors, in order of importance, are the livestock index, the number of acres in crops, the crop-index, and the efficiency of use of man-labor (months of man labor). Compared to the net coefficients for these factors, all others are relatively negligible.

It is interesting to note that the net effect of an increase of one point in either index has almost identical effect upon the labor income. Productiveness of stock and of crops is fundamental to profitable farming.

Proper size of business is also essential. It would appear that crop acres, more than any other single factor, was the best criterion of the effect of size of business upon the labor income. For each additional acre in crops, the net average increase in labor income was \$12.

The negative correlation with man labor shows the importance of proper utilization of human energy. For every month's labor that a farmer was able to dispense with, without changing any of his enterprises, his profits were increased \$52—approximately the cost of the labor saved.

The net relation between capital and labor income is interesting. As usual, 5 per cent interest on investment was deducted from the farm income to determine the labor income. The net regression of — 3.6 shows that this deduction was 3.6 per cent too high. All that capital actually contributed to the farm income in this area the year of the survey was 1.4 per cent on the investment. The results for the other factors are all just as they would have been had interest been computed at this rate; the only difference being that in that case the net correlation of the amount of capital with labor income would have been zero, the deduction of the true interest having eliminated all correlation. This point is highly significant for the light it throws on one common fallacy in analyzing farm management surveys. In cases where the assumed interest rate exceeds the actual average net earnings of capital, as in this case, there is introduced an artificial bias against the larger farms;

while in cases where it is less than the true earnings, the bias is in the other direction. In either case, tabulations of labor income, which is assumed to show net profit with the earnings of capital eliminated, are bound to be in error due to the imperfect method of eliminating its contribution.

It would appear that in this area and year efficiency in the use of horse labor was not nearly so important as efficiency in the use of man-labor, the net correlation of crop acres per horse with labor income being practically zero. This may be partly due to there being much less variation in the efficiency of the use of horse labor than of man labor.

The intensity of stocking (productive animal units) alone apparently had no effect upon labor income. The type of stock, however, did. Compared to poultry, the most profitable type, dairy cattle ranked next, swine next, and beef cattle last. The net regressions for these factors may be interpreted in this way: For every per cent of total receipts that came from dairy products instead of from poultry, labor income was decreased \$6; if from swine, \$13.50, and if from cattle, \$16.70. It would appear that this year it was more profitable to sell crops than to feed, unless fed to poultry; the effectiveness of receipts from crops outranking the other income factors, but being \$2.50 "per per cent" below poultry receipts.

Proper utilization of farm area is apparently very profitable, each additional per cent utilized increasing the income over a hundred dollars. As might be expected, corn was most profitable, outranking small grains by \$9.50, and hay or pasture by \$12.50, "per per cent" of area. As was pointed out previously, the acre values of both corn and hay were above the average this year, while small grains were normal or even below normal. Hence in an ordinary year, corn might not be so much more profitable than small grains, nor grass nearly so profitable in proportion.

Summary of the Partial Correlation Results.

Of sixteen farm organization "factors" considered, efficiency in live stock and crop production, efficiency in the new concrete facts, though it has thrown new light on some use of human labor, and the number of acres in crops were found to be most important in determining net farm profits on the 965 Iowa farms in 1913. Beyond this, the rather

lengthy interpretation of results has brought out but little disputed points. It is presented more for an example of the method than for the intrinsic value of the results.

The real value of this study lies in the guide it offers for future work. The reader can not but help having noticed the vagueness of some of the "factors," and the great difficulty of interpretation with factors which are really composites or which bear a mathematical relationship to other factors.

Thus the percentage distributions proved quite unsuitable for correlation work. Had the crops been taken solely as acres of the different crops (and of course total crop acres left out altogether) much more satisfactory and understandable results would have been secured. Similarly, the "per cent of working capital" proved quite unmanageable. And even total capital, including the unit valuations of many things already represented, was not wholly satisfactory.

For any one attempting to use this method for future work, the following suggestions are offered:

First, thoroughly think through the problem in hand, and decide just what points the correlation analysis is to apply to. Then select as factors those which are expected to be the most important variables. Reduce each of these variables to the simplest and least complex statement, and do not allow the same thing to be included in more than one factor. Thus if land area and value are both to be studied, do not use both "number of acres" and "total value," for the value is merely acres times average price. Instead use "number of acres" and "price per acre," and the two factors will then have at least no compulsory correlation, even though there may be correlation due to other conditions. This leaves the analysis free to show up the factual relationships instead of the artificial relationship which otherwise would overshadow them. It will pay to subject each factor to searching consideration in this way so as to eliminate all possible hidden stumbling blocks before the study is made.

Finally, do not attempt to use too many factors, at least at first. The clerical labor increases much faster than even the square of the number of variables; using the method

for several four or six variable problems will give much more proficiency in its use than attempting to carry through a large-scale one, such as the one reported on here, and obtaining results of but little significance.

Limitations to the Use of Partial Correlation Analysis.

Correlation analysis of any type depends upon the assumption that the relations being studied are "linear;" that is, that the relation between one variable and another is continuous and constant within the limits of the study. Thus in the results just presented, each additional acre of crop land was declared to increase labor income, on the average, \$12.33. No distinction was made whether that acre was the first, the fiftieth, the five hundredth, or the thousandth. And all the other results have a similar lack of flexibility.

For many purely physical relationships this limitation is of no consequence; the relations are actually linear. In practically all economic studies, however, this is a very serious fault. We are not interested so much in knowing how much the average acre adds to the income as in knowing how much each additional acre adds—is it best to stop at 50, 150 or 250 acres? And even a more serious objection arises from the fact that in the case of a relationship which first increases and then decreases, as in the case of any factor applied beyond the point of total increasing returns, the *average* net increase per unit might be practically nothing, though in the lower portion of the range it was quite marked. And worst of all, factors showing a negative effect for the average might actually have a very decided positive effect in the lower portions of their range. Thus in the results given, each additional crop acre per horse decreased labor income \$7.50. Now it is quite probable that at first increasing the crop acreage per horse increased incomes, but that after a certain point the opposite effect began to appear, and the loss in the upper part of the range wiped out the gain in the lower.

From these considerations it appears that for satisfactory economic analysis some method is needed which will reveal not only the net average relationship between different factors, but the net relationship between specified portions of the ranges of different factors. Holding all other factors

constant, what is the net effect of *each special application* of this factor? And what is its effect, if instead of holding the other factors constant according to their average effects, we allow for them according to their effects considering the amount or size of each separate factor?

The method of analysis used in the example might be called "linear" net correlation analysis. A similar analysis which, in addition satisfied the demands of the preceding paragraph might be called "curvilinear" net correlation analysis. Its final result would give a series of curves to show the net effects of each unit of each variable.

The statistical technique for such an analysis has not yet been fully worked out. Some work has been done along this line, but much yet remains to be worked out before it can be adopted for general use. The necessity for such analysis in economic statistical work is presented in the hope that more able investigators will become interested in further working out the technique of this very essential laboratory tool.

Conclusions.

1. The analysis of farm survey data requires extreme care to insure that apparent results are actually due to the causes to which they are imputed.
2. Proper setting of a given study in its historical relationship is the first step to proper analysis.
3. The method of partial correlation offers a promising way to single out the effect of the many concomitant variables.
4. An actual analysis of 965 farms by this method, while throwing much light on the validity of the "factors" previously used, did not yield as significant results as had been expected.
5. This study did indicate what precautions must be taken to secure satisfactory results by the use of this method, and these are stated as a guide for other users.
6. The limitations of the method due to the assumption of "linear" relationships must be borne in mind; but there is hope that eventually these limitations can be removed, and the method used equally well for studying curvilinear relations, the characteristic economic condition.

A STUDY OF FARM OWNERSHIP IN MASSACHUSETTS

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This study was undertaken by the Department of Agricultural Economics, Massachusetts Agricultural College, for the purpose of determining what has been the experience and training of the average Massachusetts farm owner, with the hope that this information may be of use to those who are looking forward to the possession of farms in this State. Some studies of this sort have been made recently, notably one by Dr. W. J. Spillman, in 1918, entitled "The Agricultural Ladder," based on farm ownership in Minnesota, and the plan for the present study grew out of a conference with Dr. Spillman in the fall of 1918, when the feasibility of undertaking other studies of like character was considered.

Method.

The method pursued included the preparation of a questionnaire, which was framed after consultation with the county agents of the State and others interested in farm ownership problems.

The number of schedules obtained, 651, was not so large as was at first intended, but probably this number is as fairly representative of the 32,000 farmers in Massachusetts as is common in such studies. No attempt was made to secure returns from a selected group of farm owners, as it was the intention to make the study truly typical of Massachusetts farmers. The only possible variation from this was in a small list of market gardeners to whom the questionnaire was mailed by the author. These names were secured from the list of members of the Boston Market Gardeners' Association. Perhaps this number might justly be called a "selected list."

The number of returns secured from certain counties is too small to warrant conclusions drawn on the basis of counties. Moreover, the counties are so small and so much alike in character that it has been thought best to divide

the State, for the purpose of this study, into the eastern, central (including Worcester county only), and western sections. Likewise, in those subjects for which data are classified by decades, the number of reports for the early decades is naturally very small, undoubtedly too small to give an accurate picture of the period. These figures are included, however, in order to insure the greatest possible accuracy in State totals.

Methods of Acquisition.

Information was collected and summarized in Table I as to the method by which the farm owners came into possession of their farms—by inheritance, gift, marriage, or purchase; and purchase was again classified into those farms purchased from relatives and those purchased from persons other than relatives.

It will be noted that some farms were not acquired by one transaction. Several owners reported that they inherited part of their land and added to it by purchase. A few others obtained a portion by gift and purchased the remainder.

Women Farm Owners

Nearly 3 per cent of the farms included in the study are owned wholly or partly by women. One woman's farm was acquired by gift, seven by inheritance and ten by purchase. All but four of these women are American born. Six were engaged in some other business before becoming farm owners. The farms owned by women range from eleven to 200 acres in size, five of them containing 100 acres or more.

Table I—Method of Acquisition of Farms

| Section of State | By Inheritance | By Gift | By Marriage | By Purchase From Relative | Other | Transactions | Farms Acquired |
|-----------------------------------|----------------|---------|-------------|---------------------------|-------|--------------|----------------|
| Eastern----- | 79 | 13 | 4 | 52 | 178 | 326 | 279 |
| Worcester----- | 21 | 2 | 3 | 16 | 82 | 124 | 119 |
| Western----- | 62 | 3 | 3 | 32 | 160 | 260 | 230 |
| Total----- | 162 | 18 | 10 | 100 | 420 | 710 | 628 |
| Percentage of transactions | 22.8 | 2.5 | 1.4 | 14.1 | 59.1 | --- | --- |
| Percentage of farms reporting---- | 25.8 | 2.9 | 1.6 | 15.9 | 66.9 | --- | --- |

Acquisition by inheritance, while forming 23 per cent of the reported transactions, varies from 17 per cent in

Worcester county to 24 per cent in both the eastern and western sections of the State.

A constantly decreasing proportion has been acquired by inheritance since 1880-89. One-half the farms reported acquired in that decade were inherited wholly or in part, but the number so secured in the decade 1910-19 was but 18 per cent of the number of farms which changed ownership during the period.

Table II—Methods of Acquiring Farms, by Decades
Transactions by Which Farms Were Acquired

| Date | Inheritance | Gift | Marriage | Purchase from | | Total Transactions Reported | Total Farms Acquired |
|---------|-------------|------|----------|---------------|-------|-----------------------------------|----------------------------|
| | | | | Relative | Other | | |
| 1840-49 | 1 | -- | -- | 1 | 1 | 3 | 1 |
| 1850-59 | -- | -- | -- | 1 | 1 | 2 | 3 |
| 1860-69 | 3 | -- | -- | 2 | 4 | 9 | 7 |
| 1870-79 | 12 | -- | -- | 11 | 13 | 36 | 27 |
| 1880-89 | 21 | -- | 2 | 13 | 30 | 66 | 40 |
| 1890-99 | 30 | 4 | -- | 21 | 65 | 120 | 109 |
| 1900-09 | 34 | 4 | 2 | 15 | 122 | 177 | 166 |
| 1910-19 | 43 | 7 | 2 | 25 | 162 | 239 | 235 |
| Total | 144 | 15 | 6 | 89 | 398 | 652 | 588 |

While most farms reporting were acquired wholly or in part by purchase, one-fourth were obtained at least partly by inheritance. Of this group of 163 farmers, 93 per cent were farmers' sons, the remaining 7 per cent inheriting farms from someone beside their fathers.

Table III—Persons Who Inherited Farms

| Counties | Farmers' Sons | Non- Farmers' | Total | Worked with Father | Did not Work with Father | Average Age at Separation | Av. age Acqui- sition of Farm |
|-----------|------------------|------------------|-------|--------------------------|--------------------------------|---------------------------------|--|
| Eastern | 75 | 5 | 80 | 76 | 4 | 27.3 | 34.1 |
| Worcester | 17 | 3 | 20 | 17 | 3 | 30.2 | 36.6 |
| Western | 59 | 4 | 63 | 59 | 4 | 32.1 | 33.3 |
| Total | 151 | 12 | 163 | 152 | 11 | 29.8 | 34.1 |

Nearly 94 per cent of the group worked with or for their fathers, becoming independent of their fathers' business at the average age of 30 years. After a period of more than four years they came into possession of the farms inherited, at the average age of 34 years. The subject of inheritance by farmers' sons will be more fully discussed in a later connection.

A small number, but 3 per cent, of the farms have been acquired by gift, while a still smaller number, 1.5 per cent, have been obtained by marriage.

Four-fifths of all farms reporting were acquired wholly or in part by purchase. (Table I.) Classified by decades the purchase of farms has exceeded all other methods of acquisition, varying after 1870 from 65 per cent to 77 per cent of reported transactions. (Table II.) Purchase of farms from relatives constituted less than 20 per cent of all purchases.

Farms purchased from non-relatives constituted 59 per cent of all reported transfers (Table I), and by decades the percentage increased quite uniformly from 36 per cent in 1860-69 to 68 per cent in 1900-09, remaining practically stationary since that period.¹

A similar study made in Kansas² shows noticeable differences in the proportions of farms acquired by the various methods in that State and in Massachusetts. The figures, reduced to comparable percentages, are presented in Table IV.

Table IV—Percentage of Farms Acquired by Various Methods in Kansas and Massachusetts

| State | Inheritance | Gift | Marriage | Purchase | Homesteading |
|---------------------|-------------|------|----------|----------|--------------|
| Kansas ----- | 7.4 | 3.6 | 1.8 | 73.9 | 13.3 |
| Massachusetts ----- | 22.8 | 2.6 | 1.4 | 73.2 | ---- |

How Farms Were Paid For.

Separating farms purchased according as "cash" (meaning the total price paid at the time of purchase) or "part-cash" payment was made, and according as farms were bought from relatives or from non-relatives, it appears that more farms were purchased from non-relatives on a "part-cash" basis, this group comprising 52.5 per cent of all purchases. Purchases from non-relatives for "cash" comprised the next largest class, practically 26 per cent of all purchases; 15 per cent of such transactions were from relatives for "part-cash," while the remainder of the purchases were from relatives for "cash."

The source of money with which farms were purchased is an interesting phase of the question of farm acquisition. The purchase money has often been acquired by a combination of

(¹) The percentage of farms purchased in later decades is increased because of the influence of mortality. Inherited farms are without doubt received at a younger age, on the average, than are purchased farms. Hence the percentage of inherited farms in the earlier decades is raised.

(²) Director's Report, 1918-19, Kansas Agricultural Experiment Station. It must be recognized that these figures are not entirely comparable, since the Massachusetts data are on the basis of transactions, whereas the Kansas data are on the basis of farms.

methods. Some 13 per cent secured it in farming and in other business, while a small group earned part in farming, inheriting the rest; still other and smaller groups secured it by various other combinations of methods.

Table V—Acquisition of Purchase Money

| Counties | Inheritance | Gift | Earned in | | Total Reports |
|-----------------|-------------|------|-----------|----------------|---------------|
| | | | Farming | Other Business | |
| Eastern----- | 21 | 5 | 106 | 108 | 240 |
| Worcester----- | 11 | 1 | 35 | 58 | 105 |
| Western----- | 19 | 5 | 96 | 76 | 196 |
| Total----- | 51 | 11 | 237 | 242 | 541 |
| Percentage----- | 9.4 | 2.0 | 43.8 | 44.7 | --- |

Loans

Loans, classified by decades, show a steady relative increase from 1870. Farmers reporting for the preceding decade are too few in number to be fairly representative of the period and are therefore not to be considered in comparison with the decades following.

The sources from which these loans were obtained were divided into (1), those received from banks; (2), those received from relatives; (3), those obtained from neighbors, and (4), those secured from other sources.

Some few of the loans in the last two decades were secured from the Federal Land Bank, but these have not been classified separately from other bank loans.

Table VI—Sources of Farm Loans to 599 Massachusetts Farmers, by Decade of Acquisition of Farms

| Date | Bank | Relative | Neighbor | Other | Total Loans | Number Reporting | Per cent of Farmers Reporting Loans |
|----------------------------|------|----------|----------|-------|-------------|------------------|-------------------------------------|
| 1870-79----- | 6 | -- | -- | 2 | 8 | 30 | 26.6 |
| 1880-89----- | 7 | 5 | 2 | 9 | 23 | 59 | 38.9 |
| 1890-99----- | 22 | 9 | 6 | 14 | 51 | 113 | 45.1 |
| 1900-09----- | 40 | 18 | 11 | 31 | 100 | 167 | 59.8 |
| 1910-19----- | 65 | 17 | 17 | 50 | 149 | 230 | 64.8 |
| Total----- | 140 | 49 | 36 | 106 | 331 | 599 | 55.2 |
| Per cent of all loans----- | 42.3 | 14.8 | 10.9 | 32.0 | --- | --- | --- |

Loans from relatives vary from nearly 22 per cent of all loans in 1880-89 to 11 per cent in 1910-19. The decrease was not, however, steady from decade to decade.

Those from neighbors form, for the five decades, nearly 11 per cent of all loans. This source reached its highest proportion in the decade 1890-99.

Increasing need for loans is without doubt one of the reasons the average age of farmers at the time of acquiring farms is greater now than in preceding decades. The higher standard of living, the need for more farm equipment and for better stock, and the increased price of farm land have united to make a larger capital necessary to the man purchasing a farm. This has naturally increased the demand for agricultural loans. Other studies indicate that credit facilities seem not to have kept pace with the demand.

There has been a constant increase in values of Massachusetts farm property from 1880 to 1920, the greatest increase having occurred during the last twenty years studied. The percentage of total farm values chargeable to land has varied but little since 1900, data being unavailable for land as separate from buildings prior to this date. Although, in relation to total investment, it has declined somewhat since 1900, actually it has increased 68 per cent. Large as this increase has been, it is less than that of any other item.

The value of machinery and implements per farm shows the greatest percentage increase, four and one-half times what it was in 1880; the percentage of total farm value invested in these items in 1920 is, however, but twice what it was in 1880.

Table VII—Average Value per Farm of Land, Buildings, Machinery and Implements, Livestock and All Farm Property in Massachusetts, 1880-1920 ¹

| | Land | Buildings | Land and Buildings | Machinery and Implements | Livestock | All Farm Property |
|-----------------|---------|-----------|-----------------------|--------------------------------|-----------|----------------------|
| 1880 ----- | ----- | ----- | \$3,807 | \$134 | \$337 | \$4,278 |
| 1890 ----- | ----- | ----- | 3,710 | 173 | 413 | 4,296 |
| 1900 ----- | \$2,309 | \$1,882 | 4,191 | 234 | 419 | 4,843 |
| 1910 ----- | 2,859 | 2,401 | 5,260 | 313 | 562 | 6,135 |
| 1920 ----- | 3,885 | 3,748 | 7,633 | 605 | 1,048 | 9,385 |
| Increase | | | | | | |
| 1880-1920 ----- | ----- | ----- | 100.5% | 351.5% | 211% | 117% |
| Increase | | | | | | |
| 1900-1920 ----- | 68.2% | 99.1% | 82.1% | 158.5% | 150.1% | 93.8% |

Table VIII—Percentage of Value per Farm in Land, Buildings, Machinery and Implements, and Livestock in Massachusetts, 1880-1920

| | Land | Buildings | Land and Buildings | Machinery and Implements | Livestock |
|------------|-------|-----------|-----------------------|--------------------------------|-----------|
| 1880 ----- | ----- | ----- | 88.9 | 3.1 | 7.9 |
| 1890 ----- | ----- | ----- | 86.3 | 4.0 | 9.6 |
| 1900 ----- | 47.6 | 38.8 | 86.4 | 4.8 | 8.6 |
| 1910 ----- | 46.7 | 39.1 | 85.8 | 5.1 | 9.2 |
| 1920 ----- | 42.6 | 39.0 | 82.5 | 6.5 | 11.2 |

¹ United States Census, 1920.

Income

Table IX—Sources of Income and Proportion of Income Derived From Farm

| Counties | Farms Reporting | Reporting Income | | Farming Only Business | Proportion of Income from Farm | | | |
|-----------------|-----------------|---------------------|-------------|-----------------------|--------------------------------|--------------|----------------|-------|
| | | from Other Business | Investments | | All | Half or more | Less than Half | None* |
| Eastern | 245 | 93 | 39 | 152 | 111 | 68 | 33 | 1 |
| Worcester | 122 | 59 | 22 | 63 | 44 | 27 | 34 | 3 |
| Western | 231 | 88 | 23 | 146 | 129 | 56 | 29 | 5 |
| Total | 598 | 240 | 84 | 361 | 284 | 151 | 96 | 9 |
| Per cent | | 40.3 | 14.1 | 60.4 | 47.7 | 25.3 | 16.1 | 1.7 |

*Farm used as place of residence only.

Table X—Surplus, Savings and Proportion of Surplus Invested in Farm Improvements

| Counties | Number of Reports | No Surplus Reported | Reporting Surplus only* | Proportion Invested in Farm Improvements | | | | Reporting Savings |
|-----------------|-------------------|---------------------|-------------------------|--|--------------|----------------|------|-------------------|
| | | | | All | Half or more | Less than Half | None | |
| Eastern | 242 | 67 | 67 | 50 | 37 | 19 | 2 | 69 |
| Worcester | 109 | 50 | 12 | 34 | 6 | 7 | -- | 19 |
| Western | 220 | 61 | 76 | 41 | 37 | 5 | -- | 40 |
| Total | 571 | 178 | 155 | 125 | 80 | 31 | 2 | 128 |
| Per cent | | 31.2 | 27.1 | 52.5 | 33.6 | 13.0 | 0.8 | 22.4 |

*This group reported merely that they had a surplus, but gave no other information concerning it.

The study included the question of surplus, one of the queries being, "Does your farm yield a surplus over living expenses?" About 88 per cent answered this question, even though it is rather personal. Other questions asked were: "What proportion of this surplus has been invested in farm improvements in the past five years?" "How much has been saved?" Of those who answered these questions, 69 per cent report a surplus over living expenses.

Of those stating the use made of the surplus above living expenses, more than half report that all this surplus was invested in farm improvements, while more than 86 per cent invested half or more of it in this manner. Less than one per cent report no improvements made in the last five years. In addition to expenditures for farm improvements, more than one-fifth of those reporting state that they have savings invested in some other way.

Subsidized Farms

Ever since colonial days many farms of Massachusetts have been subsidized, i. e., supported in part, by some other business or source of income. In the early history of the

Commonwealth, members of the farm families did certain kinds of work in the home, such as spinning and weaving, making casks and barrels, hats and shoes. The products of this labor were sold to supplement the farm income.

Later, with the rise of the factory system, workers were often secured from the farms. These were sometimes the daughters of the farm families, who remained in the factories the year round, and sometimes the men went into the factories during the period when the farm work was slack. Still later, it was possible for these workers to live at home, as factories were established within communicating distance of the farming sections of the State.

Income From Other Business

A total of 43 per cent report some portion of their incomes from other business than farming, and 14 per cent receive part of their incomes from investments.

Of those who report the "other business" in which they are engaged, 54 per cent are artisans of some sort, 39 per cent are in business, 34 per cent in administrative positions and nearly 5 per cent as clerks. Approximately 7 per cent are professional men.

Many of the artisans who are also farm owners are foreigners and have small farms in the vicinity of large cities where they can work in mills and factories. The farm work is done either by the owner outside factory hours or by his wife and children. Some of these men have thus conducted two forms of business for years, while others are working at the outside business only in order to pay for the farm, evidently expecting to confine their operations solely to the farm when the indebtedness is paid.

Experience Previous to Farm Ownership.

The whole group of 515 farm owners reporting fully on the subject of experience was classified into eight groups: (Table XI.) (1) Those who had no experience before becoming owners of farms other than that gained in connection with their fathers' business; (2) those who had experience as farm laborers only before acquiring farms; (3) those who were tenant farmers only before becoming farm owners; (4)

those who were previously in some business other than farming; (5) those who had experience as farm laborer and as tenant farmer before acquiring a farm; (6) those who served as farm laborer for a period before going into other business; (7) those who were tenant farmers and engaged in some other kind of business before securing farms; and (8) those who had experience of all three kinds previous to becoming farm owners. It must, of course, be recognized that the numbers in some groups are too small to warrant generalizations therefrom.

Table XI—Experience of 515 Massachusetts Farmers Prior to Farm Ownership

| Group | Per Cent | No. | Average Age at Leaving Fathers' Business | Average Number of Years' Experience | | | Average Age on Obtaining Farm |
|---|----------|------|--|-------------------------------------|-----------|-------------------|-------------------------------|
| | | | | as Farm Hand | as Tenant | In Other Business | |
| 1. No experience on farms except with father— | | | | | | | |
| All | 24.3 | 125 | 30 | ---- | ---- | ---- | 30 |
| Farmers' Sons | ---- | 118 | 30.3 | ---- | ---- | ---- | 30.3 |
| Non-Farmers' Sons | ---- | 7 | 26.1 | ---- | ---- | ---- | 26.1 |
| 2. Farm laborers only— | | | | | | | |
| All | 17.1 | 88 | 21.2 | 9.7 | ---- | ---- | 30.9 |
| Farmers' Sons | ---- | 72 | 21.8 | 9.9 | ---- | ---- | 31.7 |
| Non-Farmers' Sons | ---- | 16 | 18.2 | 9.6 | ---- | ---- | 27.8 |
| 3. Tenants only— | | | | | | | |
| All | 2.7 | 14 | 25.1 | ---- | 9.6 | ---- | 34.7 |
| Farmers' Sons | ---- | 14 | 25.1 | ---- | 9.6 | ---- | 34.7 |
| Non-Farmers' Sons | ---- | 0 | ---- | ---- | ---- | ---- | ---- |
| 4. Business other than farming— | | | | | | | |
| All | 29.3 | 151 | 21.2 | ---- | ---- | 14.1 | 35.3 |
| Farmers' Sons | ---- | 102 | 21.6 | ---- | ---- | 13.1 | 34.7 |
| Non-Farmers' Sons | ---- | 49 | 20.2 | ---- | ---- | 16.6 | 36.8 |
| 5. Laborer and tenant— | | | | | | | |
| All | 5.6 | 29 | 19.2 | 8.9 | 8.0 | ---- | 36.1 |
| Farmers' Sons | ---- | 26 | 19.6 | 8.4 | 7.5 | ---- | 35.5 |
| Non-Farmers' Sons | ---- | 3 | 15.7 | 13.0 | 10.7 | ---- | 39.4 |
| 6. Laborer and other business— | | | | | | | |
| All | 14.4 | 74 | 18.4 | 5.6 | ---- | 12.0 | 36.0 |
| Farmers' Sons | ---- | 59 | 18.8 | 5.9 | ---- | 11.9 | 36.6 |
| Non-Farmers' Sons | ---- | 15 | 16.7 | 4.7 | ---- | 12.5 | 33.9 |
| 7. Tenant and other business— | | | | | | | |
| All | 3.5 | 18 | 20.2 | ---- | 5.5 | 10.8 | 36.6 |
| Farmers' Sons | ---- | 11 | 21.5 | ---- | 5.4 | 11.5 | 38.4 |
| Non-Farmers' Sons | ---- | 7 | 18.4 | ---- | 5.6 | 9.7 | 33.7 |
| 8. Laborer, tenant and other business— | | | | | | | |
| All | 3.1 | 16 | 17.8 | 6.5 | 8.5 | 6.4 | 39.0 |
| Farmers' Sons | ---- | 13 | 17.9 | 6.8 | 7.2 | 7.0 | 38.9 |
| Non-Farmers' Sons | ---- | 3 | 15.7 | 5.3 | 14.3 | 4.0 | 39.3 |
| Average | ---- | ---- | 22.8 | 6.6 | 7.8 | 12.8 | 33.6 |

Group 1. Those whose only experience was gained in business with their fathers remained with their fathers for an average of nine years after they had attained their majority, becoming owners of farms at thirty years of age.

The farmers' sons of the group—some 28 per cent of all farmers' sons reporting—were about four years older when they left their fathers' farms than were the non-farmers sons' of the group. These latter obtained their farms when they were twenty-six years old—the earliest age at which farms were acquired by any group.

Group 2. Seventeen per cent of all farmers had experience as farm laborers only before ownership, after separating from their fathers' business at the average of twenty-one years of age. The sons of non-farmers in the group became independent of their fathers' business at the age of eighteen years, worked as farm laborers for a slightly shorter period than did the sons of farmers, and obtained their farms four years earlier than the farmers' sons with the same experience, who seem to have given these four years of labor to their fathers without advantage to themselves in gaining independent ownership. The experience gained during the period may, however, have been sufficient to offset the disadvantage in time.

Group 3 was very small and made up entirely of farmers' sons. Remaining with their fathers longer than any other group. They were tenant farmers for almost 10 years, the longest term served on rented farms.

Group 4 was composed of those who had no independent farm experience before becoming farm owners, having been only in some other form of business. These men, nearly 30 per cent of the whole number reporting, spent fourteen years in other business before they attained farm ownership. The farmers' sons of this group, comprising one-fourth of all farmers' sons, stayed over a year longer with their fathers than did the sons of men not farmers, but spent a year less in other business.

In group 5, not quite 6 per cent of all farmers reporting, are those who had experience as farm laborers and as tenant farmers before acquiring farms. Leaving their fathers' employ at nineteen, they worked nearly seventeen years as farm hands and tenant farmers.

In Group 6, which comprises nearly 15 per cent of the whole number of farmers reporting, the farmers' sons left their fathers at eighteen years, worked as farm laborers and in some other business for a period averaging seventeen

years before returning to farms of their own. Those who were sons of non-farmers left their fathers a little earlier and became owners of farms two and one-half years earlier than the farmers' sons.

Those who had experience as tenant farmers and in some business other than farming, comprising Group 7, made up 3.5 per cent of all farmers. These men became owners of farms at thirty-six years, having left their fathers' business before attaining their majority, rented farms for more than five years, and engaged in other business for an average of nearly eleven years. Presumably, however, the order of these two forms of experience was reversed. It is probably true that most of the men went into some other business and then rented farms before acquiring farms of their own.

Group 8, composed of those who had experience of all three types, constituted but 3 per cent of the whole number¹. Although they left their fathers' business at 17.8 years of age, earlier than any other group, they acquired their farms when just thirty-nine years old, the greatest average age for any group.

Table XII—Comparative Experience of Massachusetts and Western Farmers Who Were Farmers' Sons

| Group | Percentage | | Age at Separation from Father's Business | | Number of years of Experience as | | | | Age at Acquisition of Farm | |
|-------|------------|------|--|------|-------------------------------------|-------|--------|-------|-------------------------------|-------|
| | | | | | Farm Laborer | | Tenant | | | |
| | | | | | West | Mass. | West | Mass. | West | Mass. |
| 1--- | 34 | 28.4 | 26.5 | 30.3 | -- | -- | -- | -- | 26.5 | 30.3 |
| 2--- | 13 | 17.3 | 19.0 | 21.8 | 10 | 9.9 | -- | -- | 29.0 | 31.7 |
| 3--- | 32 | 3.4 | 23.0 | 25.1 | -- | -- | 9 | 9.6 | 32.0 | 34.7 |
| 4--- | 20 | 9.3 | 19.0 | 19.1 | 7 | 7.3 | 10 | 7.4 | 36.0 | 36.6 |

A comparison of the experience of farmers' sons who became farm owners in Massachusetts and in the West² shows that farmers' sons who went directly from their fathers' farms to farms of their own were in somewhat greater proportion in the West than in Massachusetts, and attained ownership four years earlier than did the Massachusetts men. The percentage of western farmers who, after their experience with their fathers, were employed as hired farm laborers was considerably smaller than that of Massachusetts farmers of the group. They

¹ In Kansas those having all these types of experience formed 4 per cent of all farmers.

² "The Agricultural Ladder," by W. J. Spillman, Bulletin 2 of the American Association for Agricultural Legislation, 1919.

separated from their fathers' business nearly three years earlier than the Massachusetts men having the same experience, and spent practically the same length of time as hired men. The average western farmer, however, secured his farm at twenty-nine years of age while the Massachusetts man of the group was nearly three years older before he came a farm owner. Farmers of the western States who had experience as tenants only, after leaving their fathers' farms, constituted 13 per cent of all farmers while in Massachusetts they composed a trifle over 3 per cent. The Massachusetts man of this group was two years older than the western man, rented a farm about six months longer, and was nearly three years older when he became a farm owner.

One-fifth of the western farmers had experience as both hired farm laborers and as tenants, while but 9 per cent of the Massachusetts farmers had similar experience. They left their fathers at the same age, and worked as hired men for practically the same length of time, but the western men averaged 10 years on rented farms while the Massachusetts farmers were tenant farmers for less than 8 years, but did not obtain possession of their farms until they had reached the age of 36.6 years, due to the fact that one-third of the group spent an average of 7 years in some other business before becoming farm owners. The western men, on the contrary, had no experience but farm experience of some sort, and gained possession of their farms at 36 years. Had the Massachusetts men gone from tenancy directly to ownership, they would have done so at the age of about 34 years.

It is interesting to note that while one-half of all farmers reporting had some experience as tenant farmers, the proportion of tenancy in Massachusetts did not reach 10 per cent at any time in the four decades from 1880 to 1920. It fell in the last decade to 7 per cent.

The average Massachusetts farmer of this report, whatever his experience, left his fathers' business just before his twenty-third birthday and became a farm owner 11 years later. Those who were themselves farmers' sons varied but little from the average, while those whose fathers were not farmers became independent of their fathers' business at 20 years of age and acquired farms of their own, regardless

of experience, when 34 years old. Those who had experience as farm laborers spent on the average a little over 8 years in this capacity, and 40 per cent of all farm owners were at some time employed as hired men, in addition to those men who went directly from their fathers' farms to farms of their own. Those who were tenant farmers, 15 per cent of all farmers reporting, occupied rented farms for nearly 8 years.

The farmers who were at some time engaged in some other business constituted slightly over one-half of the whole number and spent on the average nearly 13 years in that other business. The farmers' sons spent practically the average time as farm hands or as tenant farmers, but those who engaged in other business remained in it a slightly shorter time than the average.

In Kansas it was found that 55.3 per cent of farm owners had worked at some time as hired men, either for their fathers or for others, while two-thirds had been tenant farmers. A little over two-fifths of the farmers of that State had experience as both farm laborer and tenant farmer before becoming farm owners; and more than one-fourth were tenant farmers only before becoming owners of farms.¹

Farms Previously Owned.

Most farmers of Massachusetts have owned no other farm than that which they now possess. Of the 129 who report the ownership of other farms, 28 owned two or more and one man has owned six farms, all located in Massachusetts. Indeed, 80 per cent of all farms previously owned were located in Massachusetts, and 93 per cent in New England.

But three farmers report having owned farms outside the United States, and one of these was not foreign-born. The other two alone of 133 farmers of foreign birth reporting owned farms before coming to this country. Many, however, had experience as farm laborers in their home lands.

Table XIII—Farmers Who Previously Owned Farms

| Counties | Number Reporting | No. of Farms | Location of Farms Previously Owned Elsewhere in | | | |
|-------------------------------------|------------------|--------------|---|----------|-------|---------|
| | | | Mass. | New Eng. | U. S. | Foreign |
| Eastern ----- | 46 | 61 | 46 | 12 | 3 | — |
| Worcester ----- | 30 | 43 | 35 | 5 | 1 | 2 |
| Western ----- | 53 | 69 | 58 | 5 | 5 | 1 |
| Total ----- | 129 | 173 | 139 | 22 | 9 | 3 |
| Per cent of all farmers ----- | 19.8 | ---- | 21.4 | 3.4 | 1.4 | .5 |
| Per cent of other farms owned ----- | ---- | ---- | 80.4 | 12.7 | 5.2 | 1.7 |

¹ Director's Report, 1918-19, Kansas Agricultural Experiment Station, pp. 10-11.

Ages of Farm Owners.

The ages of 640 farm owners of Massachusetts average 52.5 years, ranging from twenty-four to ninety-two years individually. This average corresponds very closely to the age of approximately 51.5 years reported by the census of 1920. It is important to note that approximately 43.5 per cent of the farm owners in Massachusetts reported by the 1920 census were 55 years of age or over, and nearly 20 per cent were sixty-five years old or over.

More significant than this, however, is the age of farmers at the time of acquiring their farms. Some few report the acquisition of farms in the decades of 1840, 1850 and 1860, but the number in each decade is very small. It is, of course, not difficult to determine when the farmers who reported acquired their farms, but it is very evident that of those who acquired their farms in the earlier decades, more of those who were comparatively young at the time of acquisition have survived. Many who were more than thirty years of age when they acquired their farms in the decade 1870-79, for example, are probably not surviving at this time. Hence the groups for 1870-79 and 1880-89 are probably largely and of necessity selected from those who obtained their farms when comparatively young. Careful calculation shows that this error is probably comparatively slight in the decade 1890-99 and thereafter. Consequently more dependence can be placed on the facts indicated by these figures than on those for earlier decades. In the tables presented, however, only those farmers who attained ownership from 1880-1919 are considered.

For this period of four decades the average age at which farmers came into possession of their farms was thirty-five years. The average age of 113 farmers who acquired farms in the decade 1890-99 was just over thirty-three years when they became farm owners. In 1900-09 the average age of 159 men who attained ownership was 36.4 years, more than three years above that in the previous decade. For the decade 1910-19 an increase of one year appears over the preceding ten years, the average age being nearly thirty-eight years. This exceeds by 4.5 years the average for the 1890-99 period.

Table XIV—Average Age of Massachusetts Farmers at Acquisition of Farms, 1870-1919

| Decade | Number | Average Age |
|-------------------|--------|-------------|
| 1870-79 | 30 | 25.0* |
| 1880-89 | 59 | 28.4* |
| 1890-99 | 113 | 33.2 |
| 1900-09 | 159 | 36.4 |
| 1910-19 | 192 | 37.7 |
| 1890-1919 average | | 36.0 |

*These age averages are not accurate since a number of those who from 1870 to 1890 acquired farms at advanced ages have died, leaving a proportionally greater number of those who became farm owners at an early age.

This increase is less than that among the farmers of the corn-belt states, as shown by a study made in Iowa in 1915.¹ According to this report, the age at which Iowa farmers secured their farms had increased 6 years in the 25 years from 1890 to 1915. In Massachusetts during the same period the increase was about 4 years.

The age at which the average Iowa farmer obtained his farm in 1895 was twenty-eight years, while the Massachusetts farmer did not come into possession of his farm during this decade, 1890-99, until he had reached the age of thirty-three years. In 1915 the Iowa man attained farm ownership at thirty-four years, but the would-be farmer of Massachusetts did not obtain possession of a farm in that decade until he was thirty-seven years old.

The reported age at which men become farm owners in Kansas has steadily increased from 24.6 years in the period from 1870 to 1880, to 34.7 years in the years from 1915 to 1919.² This increase is practically the same as that indicated by the uncorrected age figures of Massachusetts farmers for the same period.

Obviously those men who became farm owners in the early years of the period under discussion and who are still farming, secured their farms when comparatively young. Most of the men who, in 1870-79 became farm owners at the age of thirty-five to forty, if now living, have relinquished their farming operations to younger hands. To a lesser degree this is true of those who acquired farms from 1880 to 1889. More deaths have occurred among the older men who became owners since 1895 than in the younger age groups, but their influence on the total is rather negligible.

¹Lloyd, Farm Leases in Iowa, Bulletin 159, Iowa Agricultural Experiment Station.

² Report of Kansas Experiment Station, 1920.

The increasing age of Massachusetts farm owners at the time of acquiring their farms has apparently been due to several causes. Which has been the most potent factor, it is impossible to say. Prominent among them, however, is the necessity for greater investment in equipment. This has been steadily increasing and the farmer who does not provide himself with the proper equipment is in no position to compete with his neighbors.

The average value of farm implements and machinery has increased from \$2.81 per acre of farm land in Massachusetts in 1900 to \$4.02 in 1910, and to \$7.32 in 1920, an increase of 150 per cent in the two decades.¹ This, added to the higher price of land itself, makes it necessary for the man who purchases a farm today to provide himself with a far greater initial capital than was necessary for the man who acquired a farm five, three or two decades ago.

The value of farm land in Massachusetts increased 21.4 per cent from 1900 to 1910, while during the last decade it increased another 21 per cent. The land which was valued at \$50 an acre in 1900 had increased to \$60.70 in 1910, and by 1920 it was valued at \$73.45. Not considering the years prior to 1900, this shows an increase in 20 years of 46.9 per cent in land values. During the same period the average age of farm owners at the time of acquiring farms rose several years, probably due in greater or less degree to the fact that it required a longer time to accumulate the necessary capital for purchasing a farm. Doubtless this handicap was to some extent offset by the better prices for farm products and higher wages for all kinds of labor during the period, but owing to the great number of occupations in which present farm owners earned the capital with which they purchased their farms, it is impossible to calculate the extent to which this increase in land values was offset by these factors. We can not say whether the earning power of the 192 farmers acquiring farms in the decade 1910-19 bore the same relation to farm land values as did that of the 30 men who became farm owners in 1870, or indeed of those 113 who secured farms in 1890-99.

¹ Changes in the general price level have had some effect upon these values. The index number of wholesale prices, Bureau of Labor, rose from 80 in 1900 to 243 in 1920. This should be borne in mind in considering the discussion of values. The ability to purchase land and equipment, of course, depends quite as much upon prices of farm products or upon wages of labor as upon the price of farm land or equipment—Editor.

In the opinion of President E. H. Thomson of the Federal Land Bank, Springfield, Massachusetts, the greatest difficulty of the man who desires to become a farmer lies in securing the proper equipment rather than in the purchase of the farm itself. The question of credit enters here, and President Thomson believes that the usual sources of credit for the farmer are more readily available for the purchase of land than for the purchase of equipment.

For present purposes, we may consider that the complete equipment of a farm includes machinery, livestock and buildings. It must be recognized that buildings may be used as the basis for loans from the Federal Land Bank, while the remainder of the equipment is not so accepted. In Table VII will be seen the changes in values of farm property in Massachusetts from 1880 to 1920. Because previous to 1900 land and buildings were not separately listed, it is impossible to compute the change in the average value of farm buildings from 1880, but since 1900 this item has risen from \$1,882 to \$3,748, an increase of 99 per cent. Livestock, from an average value of \$419 per farm in 1900, has risen to \$1,048 in 1920, an advance in the two decades of 150 per cent. The average value of all Massachusetts farm property increased nearly 94 per cent from 1900 to 1920. It is evident that the would-be farm owner must provide himself with a larger capital before attaining ownership than was necessary in the earlier years considered in this study. At present the average value of all farm property varies from \$6,608 in Franklin county to \$14,929 in Norfolk county.¹

Since greater numbers of farm owners, reporting the acquisition of farms in the later decades of the study, received high school and college educations than did those of the earlier decades, it is to be assumed that the delay in attaining farm ownership is in part attributable to this factor.

The higher standard of living among farm owners is doubtless one of the chief factors in delaying the acquisition of farms. The young farmer of today does not wish to take his wife to a home very different in kind from her father's house. He wishes to give her, so far as possible, the com-

¹ In a recent study of New Jersey agriculture, to cite one study of many which have been made, it is found that the average farmer acquiring a farm under present conditions needs a capital of at least \$10,000. Bulletin 312, New Jersey Experiment Station.

forts and conveniences to which she has been accustomed. He is not willing to subject her to the hardships which the farmer's wife of the earlier decades endured. Therefore he works a little longer to secure the added capital these things demand. It is, however, impossible to calculate the time required to meet this need.

REVIEWS

Food Production in War. By Thomas Hudson Middleton, K. B. E., C. B., L. L. D., Deputy Director-General, Food Production Department. (Oxford: At the Clarendon Press published on behalf of the Carnegie Endowment for International Peace, Pp xix, 373.)

This volume is one of the New Series of the Economic and Social History of the World War-British Series.

The book is written for the British public who are assumed to know little of elementary agriculture or the principles of nutrition; but to understand allusions to things British.

Chapter II on the resources of the farmer in 1914 is good. There are twenty-four meaty pages on the field crop and animal industry pre-war situation in England, Scotland, Ireland and Wales that are worth study as the author knows his subject.

Chapters III and IV dealing with the elementary principles of plant growth, animal feeding and human nutrition can be skipped by the American reader of average intelligence. Then follows twenty pages on "The Nation's Home-Grown Food Supply" discussing production, consumption and import requirements in which this vital problem of the British Isles is ably treated.

One hundred and fifty pages deal with the harvest of 1915, 1916, 1917 and 1918—a chapter to each. There is too much space devoted to controversies, opinions and citations of authorities that are of interest only to a Britisher with much time to kill. A few tables with footnotes would have sufficed.

Chapter X on the "End of the Food Production Campaign" is suggestive here and there; but wordy. The same is true of the final chapter—"From Food Production Back to Farming."

There are many good tables. There should have been more of them and less text.

This book might be used as a book of reference though there are better ones covering the same fields that are of interest to the American reader.

LOUIS G. MICHAEL.

Principles of Marketing. By Fred E. Clark, Ph. D. (New York: Macmillan Company, 1922, pp. xiii + 570, \$3.00.)

Clark's *Principles of Marketing* is well suited to the needs of a first course in marketing, such as given in agricultural colleges. No doubt many will think that because it purports to be a general treatise on marketing, and was worked out at Northwestern University, that it fits the needs only of schools of commerce. In this they are mistaken. The book, it is true, discusses jobbing and retailing at considerably more length than our present texts on "agricultural marketing;" but the discussion is all needed, every page of it, for the right kind of a first course in marketing in an agricultural college. It is a serious mistake in a beginning course to try to divide the marketing process into two parts on the basis of agricultural and other products.

Furthermore, Professor Clark has given to us in this volume the most complete and thoroughgoing analysis of the marketing process that has thus far appeared. It is a well written textbook. It shows everywhere that it has been painstakingly hammered out in the classroom.

However, a book may have the appearance of being well organized, especially if one considers it only a chapter at a time, and yet be wretchedly organized in fact because of a wrong general scheme of organization. Professor Clark's scheme of organization is agricultural products first, then other raw products, then manufactured products, then transportation and storage, then the auxiliary marketing functions (standardization, risk-bearing, financing) and then market price. The other "marketing functions" are introduced in connection with agricultural, raw and manufactured products. Apparently the scheme is not a good one. At least, as one would expect if this were the case, it has resulted in a good deal of repetition, and of discussing the same topic in several places. The author, in consequence, does not seem to be able to "let go" of the subject, but keeps reverting to it for further discussion.

The scheme, obviously, involves a good deal of cross-classification. The way to eliminate a large part of this is to drop the classification of agricultural, raw and manufactured products out of the plan of organization. As indicated above, such an organization scheme is contrary to the very idea of a

book on "principles of marketing," and not well suited to any first course in marketing.

It is of course a question as to whether a first course in marketing should present the principles of marketing or a description of the marketing process. Professor Clark's book, although called "Principles of Marketing," is really a description of the marketing process. That such is the case is evident from the following statement in the preface: "Economic theory has been introduced wherever it would promote the discussion of particular points." A real book on the principles of marketing will not have economic theory "*introduced*" into it—it will *be* economic theory. Such a book, however, has not yet been written, and there is question whether such a book when written will serve as a first course. There needs to be somewhere a description of the marketing process. There are two places for it, one as a separate introductory course, the other as interwoven with the principles. Probably the second plan is the better; but until a suitable textbook is written, it is not feasible. Professor Clark's book fits into the first plan, and fits in very well.

One must be careful, in this connection, not to make the mistake of calling a course based on this textbook, or for that matter on the Weld's and Macklin texts, a senior-graduate course—such a course belongs to the sophomore-junior years in an agricultural college.

There are parts of the analysis that some will not accept: for example, making selling identical with "demand creation;" and the concept of risk—it does not harmonize with Professor Knight's in at least one important respect.

JOHN D. BLACK,
Minnesota State University.

The Editor of the Journal received the following letter from Prof. J. F. W. Grosskoph, Prof. of Economics, University of Stellenbosch, South Africa:

"I hereby request your kind permission to translate into Dutch (for publication in a farmers' paper) an article by Prof. B. H. Hibbard on 'The Farmers' Influence Over Prices,' which appeared in The Journal of Farm Economics; Vol. V, No. 1 (Jan., 1923). In spite of all the differences between the conditions of our two countries, this article

puts the essential problem in such a common-sense, straightforward way that I should like our farmers to read it. As I shall derive no profit from the translation, I hope that you will see no reason for withholding your permission. Of course the source will be acknowledged, and if you wish, a copy of the translation will be sent to you."

"The Purchasing Power of Nebraska Grains" is the title of Bulletin 187, by H. C. Filley and E. A. Frerichs. The latter was a graduate student in the Department of Rural Economics. This study was based largely or altogether upon (1) grain prices paid at Columbus, Nebraska, 1877-1922, and (2) U. S. Bureau of Labor data.

J. O. Rankin has two bulletins in process of distribution and one in press. These three and one which is already out of print are based mainly upon a socio-economic land tenure survey of 1,034 farms made in cooperation with Drs. C. J. Galpin and L. C. Gray, of the Bureau of Agricultural Economics. Data from over a hundred other farms are also included making 1,141 in all. The bulletins already completed deal with human welfare phases of Nebraska farm life, but the economic data secured in the survey are being embodied in three manuscripts now in preparation for publication. The bulletins already published are Bulletin 185, entitled The Nebraska Farm Family, some land tenure phases; Bulletin 191, Nebraska Farm Homes, a comparison of some living conditions of owners, part-owners and tenants, and Bulletin 191, Nebraska Farm Tenancy, some community phases. (In press.)

NEWS NOTES

Mr. M. D. Jones, Farm Mgt. Demonstrator, writes that conditions in Maine are better than a year ago. Milk prices have been better, and poultry and egg prices are holding good, with a fair crop of apples and sweet corn in sight.

The potato situation promises to clear somewhat. A good crop is assured with prices starting off at a level comparatively higher than in 1913. Digging is starting fully ten days late due to immature conditions of the crop but such men as have begun, report yields somewhat above average. Considering the fact that the unpaid fertilizer bills in Aroostook County alone, including those on the present year's supply, are above \$9,000,000, it will be impossible for them to clean up except under unusually good conditions.

A meeting of representative men from the field of agriculture as well as from other business organizations was called by President Hetzel, of the University of New Hampshire, in the latter part of August, to consider the economic and social status of the people of New Hampshire. Addresses were given by W. S. Rossiter, formerly of the Census Bureau; Former Governor Robert P. Bass, Major Frank Knox, editor of the Manchester Union Leader, and George M. Putnam, president of the State Farm Bureau Federation. A committee was appointed to suggest ways and means of constructive study. The report of the committee was made and unanimously adopted. A committee of five was empowered to hire a trained investigator and necessary funds were contributed by those present.

The Randolph and Royalton, Vermont, Farm Business analysis survey was repeated in May, 1923. The supplementary schedule this year covered cost of butter fat production with the object in view of studying efficiency in dairying. About 210 records were secured in this area and in addition 114 similar records were taken in June at Enosburg, Vermont.

Connecticut Agricultural College is undertaking research work in Agricultural Economics for the first time this

autumn. Funds have been made available for the establishment of this work on a permanent basis. Mr. I. G. Davis has been made a member of the research staff as Research Economist and Mr. C. I. Hendrickson, who completed three years of graduate work at the University of Wisconsin this summer, will devote one-half of his time to the conducting of research work. The first project to be undertaken is an economic survey of Connecticut agriculture to determine the present status of agriculture in the State. Comprehensive economic surveys are being made in type areas throughout the State in conjunction with a statistical survey of the state of the agriculture of the State by towns. At the same time a soil survey and a land utilization survey is being made. The Bureau of Agricultural Economics is cooperating with the Connecticut Agricultural College in making these surveys. To perfect and standardize field methods, a survey is being made this autumn in the town of Lebanon, Connecticut. The Lebanon survey includes the economic land utilization and soil surveys.

Vernon C. Pinkham, who completed the requirements for his Master's Degree in Agricultural Economics at the University of Iowa this summer, is working on the Connecticut economic survey.

By action of the Board of Trustees of the Pennsylvania State College, at a meeting in June, 1923, there was established in the School of Agriculture a Department of Agricultural Economics. R. G. Bressler was made head of the new department.

Dr. L. J. Norton has resigned from the staff of the Department of Agricultural Economics and Farm Management of Cornell to accept a position in the Department of Economics in the University of Illinois. Dr. Norton assumed his new duties on September 1st.

Mr. C. H. Merchant, formerly of the Department of Agricultural Economics and Farm Management of Cornell University, has gone to Utah to accept a position in similar work at the Utah Agricultural College. Mr. Merchant will take the place of Dr. E. B. Brossard while the latter is on leave.

Mr. H. A. Ross, formerly of the Department of Dairy Industry of the University of Illinois, has accepted an instructorship in the Department of Agricultural Economics and Farm Management at Cornell and will continue his work for a doctor's degree.

Dr. F. A. Pearson, of the Department of Agricultural Economics and Farm Management at Cornell, is on leave for the present term in Washington working on the preparation of the 1923 Yearbook of the Department of Agriculture.

Mr. D. B. Wilson, of the Department of Farm Management at Texas A. & M. College, has left that institution to continue his graduate work at Cornell.

A successful Banker-Farmer Conference was held in Ithaca, July 23 and 24, under the auspices of the Department of Agricultural Economics and Farm Management of Cornell University. Eighty persons were present, including representative bankers and farmers from all parts of the Second Federal Reserve District. The conference adopted two resolutions—one, endorsing the cooperative marketing organizations of farmers, and the other recommending the holding of banker-farmer conferences in local communities of the State to promote the greater use of banks by farmers.

During the past summer Professor G. P. Scoville has continued his economic studies of fruit farming in New York State, having obtained records for the tenth successive year in a typical fruit growing area in Niagara County, N. Y.

Dr. E. G. Misner has continued the economic studies of Dairy Farming in New York begun in 1922 in cooperation with the Bureau of Agricultural Economics. The first of a series of publications based on these studies has been issued as bulletin 421, "An Economic Study of Dairy Farming in New York. I." Other publications are now in progress.

Mr. F. D. Cornell, Assistant in the Department of Farm Economics, West Virginia University, has been granted leave of absence from his work during this year and will do graduate work in Cornell University.

West Virginia University will add a new man to the staff of Farm Economics who will devote his entire time to the marketing of agricultural products. The new man will be selected in time to begin his work at the beginning of the second semester of the school year.

A study of three hundred and thirty-three typical cotton farms in South Carolina indicates that about six months of unpaid family labor (exclusive of the operators') were obtained on the average, in 1922, the exact average of the three hundred and thirty-three farms being 5.9 months. This unpaid labor consists of child labor from ten years of age up, and on many farms sons as old as twenty-five years remain on their father's farms. The farmer's wife assists a great deal with light work such as hoeing and picking cotton. Principal months worked are, May, June, September, and October.

Mr. R. F. Taber, Farm Management Demonstrator, Ohio State University, is attending Harvard University this year for graduate work.

Mr. E. J. Utz, graduate of Ohio State University, 1923, has been appointed Assistant Farm Management Demonstrator in Ohio.

Mr. George G. Buford, who has been employed by Purdue University on the Hog Cost Route during the past two years, and has been taking graduate work, resigned his position to accept employment with Swift and Company, Chicago.

Fifteen students who are doing graduate work at Purdue, are now registered in a seminar on Cooperative Marketing which is offered this year for the first time.

Professor C. E. Allred, of the University of Tennessee, is at present engaged in a study of the economic resources and possibilities of the agriculture of Tennessee. These data are to be used by the Governor of the State and the various educational agencies in mapping out a five-year program of development.

The Department of Agricultural Economics of the University of Tennessee reports more interest on the part of advanced and graduate students in taking up the study of the

economic problems of agriculture than during any previous year.

The Staff of the Department of Rural Life at the Missouri College of Agriculture has recently been increased by an Extension Specialist in Community Organization work. Mr. B. L. Hummel from Purdue University has been employed to fill this position. Extension specialists, have in the past been giving their time to the Economic side of farming. This marks a departure in this program as this man will give his entire time to the social phase of farm life.

The strawberry acreage of southwest Missouri and northwest Arkansas has been seriously reduced by the fall drouth of 1922 and the late summer drouth of 1923. This will be compensated for in part by the increase in grape acreage which has been stimulated by the location of a branch of the Welch Grape Juice factories at Springdale, Ark. From the labor standpoint this shift of these fruit crops will increase the labor in the dormant season and in August and will reduce the labor in the month of May.

Continued ravages of the boll weevil is causing a change in the type of farming in some localities. The planters at Varner, Ark., located in the delta lands of southeast Arkansas have asked for a meeting of planters and extension workers on October 16th to consider plans for raising other crops and products in addition to cotton. One of the planters in this section already has 500 acres of lespedeza which is a bumper crop. This hay has become a cash crop as well as a feed crop in a number of Arkansas counties.

On September 30, Mr. Hutzler Metzger, M. S., resigned as Assistant Farm Management Demonstrator at the North Dakota Agricultural College to take up graduate work in Agricultural Economics at the University of Minnesota leading to the degree of Ph. D. Mr. Metzger has been associated with farm management work in North Dakota for the past three years and the loss of his services will materially affect the work in the State.

Mr. T. S. Thorfinnson, who has been Agent in Farm Management for the past two years is to become Assistant Farm

Management Demonstrator, succeeding Mr. Metzger on October 1.

Mr. Stanley Wilner, who has been in charge of the cost route in Cass County, North Dakota, during the past year, will succeed Mr. Thorfinnson as Agent in Farm Management at the North Dakota Agricultural College representing the Bureau of Agricultural Economics.

Mr. J. A. Barner, who for the past two years has been assisting in cost of production studies in Stutsman County, North Dakota, will become route man on the Cass County Route, effective October 1.

Mrs. Emma Skeem Metzger, who has been chief clerk of the Department of Farm Management for the past five years, has resigned to accompany her husband, who is at the University of Minnesota.

Mr. V. R. Wertz, B. S., M. S., University of Wisconsin, and formerly a member of the staff of the school of Business and a member of the Agricultural Economics staff, University of Minnesota, joined the staff of the South Dakota State College September 1. Mr. Wertz has recently completed additional graduate work at the University of Wisconsin. He is offering two new courses not previously given, one in Statistical Method and one in Agricultural Prices.

Mr. R. E. Post, B. S., Michigan Agricultural College; M. S., University of Wisconsin, also joined the staff September 1. Mr. Post will do both instructional and statistical work.

Tabulation of certain phases of the Great Plains Survey work conducted in cooperation with the Bureau of Agricultural Economics this summer is in progress, especially those parts relating to the cost of producing feeder cattle and sheep and wool.

The research assistants of the Division of Agricultural Economics, University of Minnesota, for the present year are Mr. Hutzel Metzger, formerly at North Dakota Agricultural College; Mr. Lawrence I. Meyers, last year at Iowa State Agricultural College, and Mr. C. C. Zimmerman, last year at North Carolina College.

Mr. B. A. Holt is giving the courses in Principles of Cooperation, and Marketing Organization and Management, for-

merly given by Mr. Paul L. Miller, who is now in charge of the Marketing work at Iowa State Agricultural College. Mr. Warren C. Waite and Mr. Edwin W. Gaumnitz are assisting Professor H. B. Price and Professor R. S. Vaile in the giving of the course in Principles of Marketing.

Professor Holbrook Working spent part of his summer working on the problem of business cycles in relation to prices of farm products, in connection with the National Monetary Association.

Professor J. D. Black spent two weeks in Washington in August, working with Dr. L. C. Gray in the preparation of a bulletin on "Land Settlement and Colonization in the Great Lake States."

Dr. Edwin G. Nourse, chief of the Agricultural Economics Department of Iowa State College, resigned September 1st to take charge of agricultural economics investigations for the Institute of Economics, Washington, D. C. Dr. Nourse came to Iowa State College in 1918 and during his period of service at that institution made important contributions to the research literature of cooperative marketing. Among these may be mentioned, Iowa Experiment Station Bulletin No. 200, "Cooperative Livestock Shipping in Iowa in 1920" and Bulletin No. 211, "Fifty Years of Farmers' Elevators in Iowa." In 1921 it fell to the lot of Dr. Nourse to reorganize the then existing farm management and marketing sections into the present agricultural economics section.

Dr. C. L. Holmes, formerly Associate Professor of Agricultural Economics and assistant chief of the Iowa Agricultural Experiment Station at Iowa State College, was appointed Professor of Agricultural Economics and chief of the experiment station, effective September 1st. Dr. Holmes, who came to Iowa in 1921, has been carrying forward research work in farm organization and land economics. He now has general supervision of marketing also.

Mr. Paul L. Miller, until recently Associate Economist of the Bureau of Agricultural Economics of the U. S. Department of Agriculture, assumed his new duties as Associate Professor of Agricultural Economics and assistant chief of

the Iowa experiment Station September 1st. Mr. Miller will conduct research work in marketing.

Mr. Claude L. Benner, assistant professor of Agricultural Economics of Iowa State College, has been granted a temporary leave of absence and on September 1st joined the Staff of the Institute of Economics.

Mr. Fred M. Garlock has been appointed assistant professor of agricultural economics to serve during the absence of Mr. Brenner.

The Department of Farm Management of A. & M. College of Texas has recently been merged into the Department of Agricultural Economics. Nearly seven hundred students are enrolled in the Department of Agricultural Economics and over four hundred in the Four Year Course in Agricultural Administration.

Course number 407, Ranch Economics, is coming to be one of the most popular courses in the Department. Dr. Youngblood, Director of the Experiment Station, is offering the course, the first semester primarily to Agricultural Administration seniors and the second semester, to Animal Husbandry seniors.

V. P. Lee, who took his Doctor's Degree in Agricultural Economics at the University of Wisconsin, last June; C. M. Purves, who took his Master's Degree in Agricultural Economics at the University of Minnesota this summer, and J. C. Butler, a candidate for the Master's Degree at the University of Texas, are the new additions to the Agricultural Economics Staff this fall. Dr. Lee holds the rank of full professor; Mr. Purves and Mr. Butler hold the rank of instructor.

P. K. Whelpton, Professor of Farm Management, spent the summer at Cornell carrying on work leading toward the Master's Degree.

Frank Bardeen has been granted a year's leave of absence to pursue his studies for the Master's Degree at the University of Wisconsin. He will give considerable attention to Cooperative Accounting System.

The Department of Economics and Sociology at the State Agricultural College, Fort Collins, Colorado, cooperated with the Division of Land Economics and the Division of Farm

Management in the Bureau of Agricultural Economics, U. S. Department of Agriculture, in conducting a land settlement survey in Lincoln and Washington counties during the past summer.

Mr. Waldo F. Heppe, who has been associated for the past two years with the Department of Economics and Sociology in the Colorado Agricultural College as Extension Specialist in Marketing, has accepted a position as Field Agent for the Colorado Potato Exchange. In his new position, Mr. Heppe will give attention to the standardization and grading of potatoes and will render other expert service in developing the cooperative marketing plan of the organization with which he is connected.

The food supply of Altoona, Pa., has been surveyed under the supervision of W. A. Schoenfeld, Federal Bureau of Agricultural Economics. The object of this survey is to determine a profitable program for agricultural production in the territory adjacent to that city. The Pennsylvania State Bureau of Markets, the State College, the Blair County Farm Bureau and the Federal Bureau of Agricultural Economics will cooperate in the study which will include a survey of food consumption, nature of consumers' demands, and present sources of supply, available transportation and storage facilities, and the economic relationship of Altoona industries to food consumption.

A directory of teachers giving courses in rural sociology and rural life has recently been prepared by the Federal Bureau of Agricultural Economics. The list includes 594 colleges, normal schools, theological seminaries and universities reporting a course.

Federal rye grades became effective July 1, 1923. Five grades are provided for under the regulations.

As a further experiment in testing the tentative specifications for poultry outlined by the Federal Bureau of Agricultural Economics, that bureau has undertaken the inspection for quality and condition of poultry purchased by the Munson Steamship Lines. The service will cover the inspection of all poultry purchased for their steamships operating between New York and South American ports.

Official Standards of the United States for Grades of Wool were established by the Secretary of Agriculture and became effective July 1, 1923. The grading of wool in warehouses licensed under the warehouse act must be in accordance with the official grades. Otherwise the adoption of the grades by the trade is permissive except where State laws or local ordinances make their use compulsory.

Tentative specifications for the various grades of fresh and frozen beef have been formulated by the Federal Bureau of Agricultural Economics for use by Federal and State institutions. Mimeographed copies are now available to public institutions and to individuals who have use for them.

Farmers' business organizations are being listed as a result of a survey made by the Federal Bureau of Agricultural Economics under the immediate direction of R. H. Elsworth.

Terminal Conditions at the Port of New York as they affect the cost of marketing fruits and vegetables is the title of a preliminary mimeographed report prepared by Walter P. Hedden, Research Agent in Marketing, and cooperatively employed by the Federal Bureau of Agricultural Economics and the Port of New York Authority.

Nine to ten thousand cars of hay will be inspected annually by Federal agents at Chicago as a result of an agreement entered into between the Federal Bureau of Agricultural Economics and the Chicago Hay Exchange. The agreement provides that all hay arriving in Chicago for members of the Chicago exchange will be inspected.

AMERICAN FARM ECONOMIC ASSOCIATION TENTATIVE PROGRAM

ANNUAL MEETING—Washington, D. C., December 27-29, 1923

Thursday, December 27

What Should Be Included In the First Year's Work In Farm Management

Andrew Boss, University of Minnesota

What Should Be the Content of Marketing Courses for Undergraduates
H. C. Taylor, Chief, Bureau Agricultural Economics, U. S. Department
Agriculture

Paper (Subject to be supplied later)

A. Leitch, Ontario Agricultural College

Committee Report

A National Agricultural Program—A Farm Management Problem

Secretary Henry C. Wallace, U. S. Department Agriculture

The Commodity Cooperative—Its Strength and Weakness

H. E. Erdman, University of California

Discussion:

Carl Williams, Oklahoma Farmer-Stockman, Oklahoma City, Okla.

O. B. Jesness, University of Kentucky

President's Address

Agricultural Forecasts—Their Use and Value

(To be assigned)

Discussion:

H. C. M. Case, University of Illinois

F. A. Pearson, Cornell University

Friday, December 28

The Effect of Business Upon Agriculture

Roger W. Babson, Babson Park, Massachusetts

Discussion:

E. H. Thompson, President, Federal Land Bank, Springfield, Massachusetts

A. B. Genung, Bureau Agricultural Economics, U. S. Department
Agriculture

Geo. C. Haas, U. S. Department Agriculture

An Attempt to Determine the Future Trend of Farm Prices

G. F. Warren, Cornell University

Discussion:

F. V. Waugh, New Jersey Department Agriculture

S. H. Thompson, Iowa State College

(Joint Session with American Economic Association)

The Relation of the European Situation to American Agriculture

B. M. Anderson, Chase National Bank, New York City

European Recovery In Agriculture and the Effect on American Exports

L. G. Michael

TENTATIVE PROGRAM FARM ECONOMICS ASSOCIATION 247

The Use of Detailed Cost Studies In Improving Farm Organization In A Community

George A. Pond, University of Minnesota

Discussion:

R. H. Wilcox, Bureau Agricultural Economics, U. S. Department Agriculture

Efficient Farm Organization for Livestock Production

R. L. Donovan, Minneapolis, Minnesota

Discussion:

J. R. Fain, University of Georgia

W. D. Nicholls, University of Kentucky

Saturday, December 29

Business Meeting

Lessons From the Present Land Situation In England

J. I. Falconer, University of Ohio

Discussion:

DeWitt C. Wing, Breeders' Gazette, Chicago, Illinois

B. H. Hibbard, University of Wisconsin

The Law of the Diminishing Increment In the Feeding of Cattle and Hogs

W. J. Spillman, Bureau of Agricultural Economics, U. S. Department Agriculture

New Members Since April 1, 1923.

| | |
|----------------------|---|
| Booth, J. T. | 214 Thurston Ave., Ithaca, N. Y. |
| Center, E. S., Jr. | 120 E. Hunter St., Atlanta, Ga. |
| Childs, V. C. | 1710 Citizens and Southern Bank Building, Atlanta, Ga. |
| Cole, Lester | Great Falls, Mont. |
| Coulson, W. H. | Mason, Ohio. |
| Dale, H. C. | care of University of Idaho, Moscow, Idaho. |
| Darter Bros. and Co. | P. O. Box 36, Stellenbosch, South Africa. |
| Fluharty, L. W. | University of Idaho, State House, Boise, Idaho. |
| Greenside, Frank | 1027 College St., Fargo, N. Dak. |
| Harkness, Donald D. | Watkins, N. Y. |
| Hembre, J. O. | Baker, Mont. |
| Hopkins, E. S. | Division of Field Husbandry, Central Exp. Farm, Ottawa, Canada. |
| Lantz, H. L. | Malta, Mont. |
| Lewis, I. D. | Clemson College, S. C. |
| Long, David D. | 616 Rhodes Building, Atlanta, Ga. |
| Morse, True D. | Alpha Gamma Rho House, 805 Virginia, Columbia, Mo. |
| McCord, Jos. A. | Federal Reserve Bank, Atlanta, Ga. |

| | |
|------------------------------|---|
| McMillen, Wheeler | 381 Fourth Ave., New York City. |
| Nelson, Geo. A. | Banks, Oreg. |
| Noble, D. B. | Poplar, Mont. |
| Picha, Ben | Moorhead, Minn. |
| Posner, M. | 1317 N. Washtenaw Ave., Chicago, Ill. |
| Rice, Peter V. | 1712 Citizens and Southern Bank, Atlanta, Ga. |
| Rogers, R. H. | Farm Management Dept., Purdue University, W. Lafayette, Ind. |
| Roitsch, C. R. | 702 Carter Building, Houston, Tex. |
| Sangamon Co. Farm Bureau | Springfield, Ill. |
| Scholter, Bernard | Box 422, Orange City, Iowa. |
| Smith, W. R. | 202 Federal Building, Evanston, Wyo. |
| Stewart, James I. | Woodburn, Oreg. |
| Taylor, John T. | State College, Pennsylvania. |
| Torblaa, E. M. | County Agent, Owatonna, Minn. |
| Turlington, J. E. | Gainesville, Fla. |
| Turner, Roland | 309 Southern Railway Building, Atlanta, Ga. |
| Upton, R. M. | University of Delaware, Newark, Del. |
| Walrath, Frank J. | College of Agriculture and Mechanical Arts, Mayaguez, Porto Rico. |
| Wiley, C. A. | 1116 W. Johnson St., Madison, Wis. |
| Williams, Carl | 720 W. 19th St., Oklahoma City, Okla. |
| Yahanda, T. | 444 Bush St., San Francisco, Calif. |
| Zapoleon, L. B. | U. S. Tariff Commission, 8th and E Sts. N. W., Washington, D. C. |
| Experiment Station Library | Tifton, Ga. |
| Northwest School and Station | Crookston, Minn. |
| Dept. of Agriculture | State of Minnesota, State Capitol, St. Paul, Minn. |

Notify the Secretary.

Subscribers should be careful to notify the secretary of changes in address as soon as possible.

A few complaints to the effect that the Journal has not been sent regularly have been received. This has been found to be due largely to failure to send in the new address.

Don't depend on the Post Office to forward the Journal to you. Second-class matter is not forwarded, except when additional postage is paid. This amounts to 3c for each Journal.



The American Farm Economic Association

CONSTITUTION

ARTICLE I.

Name.—The name of the Association shall be The American Farm (Management) *Economic Association*.

ARTICLE II.

Object.—The object of this Association shall be to promote the investigation and teaching of farm management and other economic questions pertaining to agriculture.

ARTICLE III.

Membership.—The membership shall consist of persons interested in Farm Management and Farm Economics.

ARTICLE IV.

Organization.—The officers shall be a President, Vice-President, and a Secretary-Treasurer, who shall be elected for one year, and who shall serve until their successors shall qualify.

The Executive Committee shall consist of the officers, and shall have the power of appointing committees, selecting time and places of meeting, and of bringing to the attention of the members any matter which in their judgment should be considered by the Association.

There shall be three standing committees appointed annually by the Executive Committee. One of these committees shall consider the lines of investigation best adapted to the needs of the work of farm (management) *economics* at the present time and shall suggest to various investigators plans of correlation and cooperation in the work. It shall be the duty of this committee to collect, as far as possible from investigators, the lines of work to be carried out each year. The second committee shall investigate the methods of lecture and laboratory work in (management) *economics* and make suggestions to the members of the Association and to colleges intending to organize courses in farm (management) *economics*. It shall be the duty of the third committee to report on extension work in farm (management) *economics*.

ARTICLE V.

Section 1. Dues and Subscription.—The rate for members of the Association shall be two dollars per year, payable in advance. This amount is divided as follows: Annual dues, fifty cents, and annual subscription to the JOURNAL OF FARM ECONOMICS, one dollar and fifty cents.

Section 2.—Life membership in the Association may be secured by the payment of forty dollars (\$40). Funds thus obtained shall be invested and the income only spent.

ARTICLE VI.

Meetings.—There shall be held an annual meeting of the Association, the arrangements and program to be made by the Executive Committee. Notice of such meeting shall be mailed to each member at least four weeks in advance.

ARTICLE VII.

Amendments.—This constitution may be amended by a two-thirds vote of the members present at any annual meeting of the Association.